TSG-RAN Working Group 1 meeting No. 7bis *TSGR1#7bis(99)e78*
Kyongju, South Korea
October 4-October 5, 1999

Agenda Item: **Ad hoc 14**

Source: **Philips**

Title: **Proposal for CPCH Status Monitoring**

Document for: **Decision**

Introduction

In [1and 2] it was shown that there is a significant performance benefit in making the status of CPCH channels available to the UE in some way. For example, in [1], considering 30ms packets, the number of access attempts can be reduced by more than 50% if the CPCH traffic loading exceeds 50% of the available capacity. Furthermore, if access attempts are only made when a channel is known to be free, this minimises uplink interference, and power consumption in the UE.

Broadcasting this CPCH status information provides a reliable and quick way of transferring the necessary knowledge to the UE. Other methods of monitoring activity on the AICH, such as the "idle AICH method" mentioned in [2], have the disadvantage that the UE must remain in active receive mode for some time (100's of ms?) to determine CPCH status. Even after such a monitoring interval the availability of a free channel may be uncertain. All this adds set-up delay, reduces throughput and uses battery power unnecessarily.

In [3] it was proposed to use spare bits on the PICH for sending status information, and in [4] it was described how CPCH could be modified to use such status information.

The current proposal is based on the previously presented documents, but with two changes. It is now proposed to send the status bits in the downlink using gaps in the AICH (instead of PICH), since use of spare PICH bits is under discussion for other purposes. However, from the technical point of view the use of PICH remains equally viable.

The preferred format of status information is to send one status bit for each bit rate available in the set of CPCH's deployed in the cell. This is particularly suitable for use with code assignment as described in [4]. This is considered more flexible and less vulnerable to transmission errors than sending a single status word indicating the maximum available bit rate.

If the code assignment idea is not used for CPCH, the status of individual CPCH's would be signalled on the CSICH.

Proposal

Figure 1 shows the current structure of the AICH.

Figure 2 shows the structure of the proposed CSICH (CPCH Status Indicator Channel). Assuming that the control of which CPCH is accessed resides in Layer 2, then the information present on that channel would be passed to Layer 2. However, since no channel coding is applied it does not seem necessary to define an additional Transport Channel.

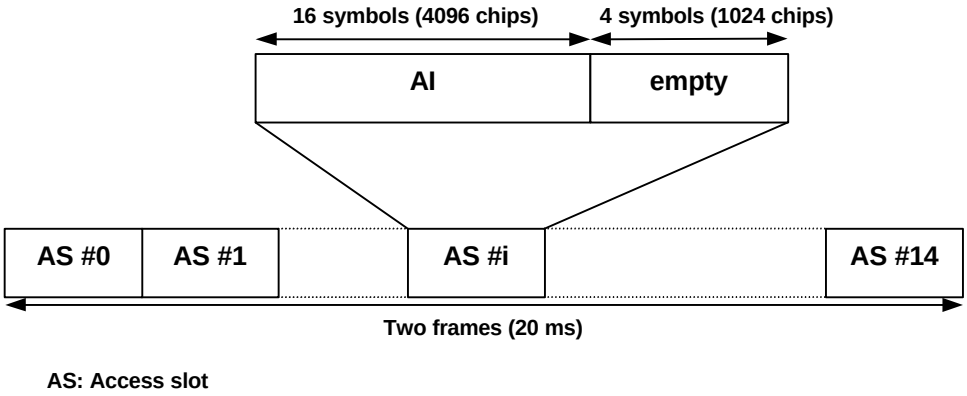

Figure 1: Structure of Acquisition Indicator Channel (AICH)

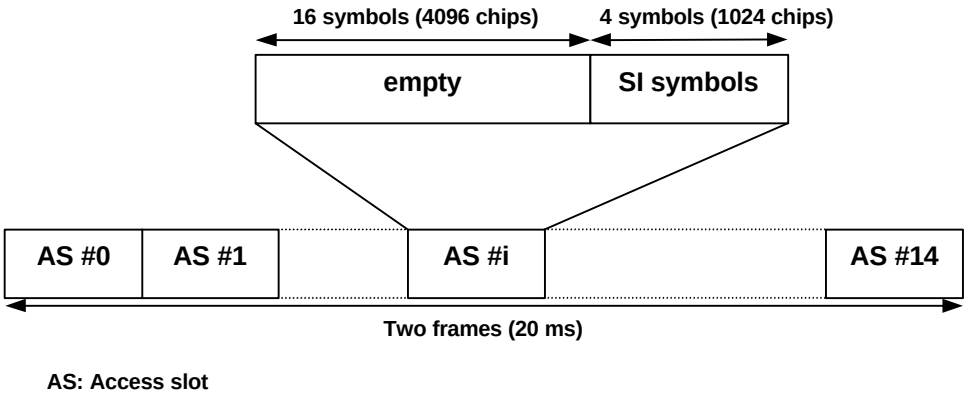

Figure 2: Structure of CPCH Status Indicator Channel (CSICH)

The status values (SI)will indicate the availability (or not) of one or more CPCH channels at the corresponding bit rate.

We propose that CSICH uses the same scrambling and channelization codes as one of the corresponding downlink AICH's (i.e. the AICH responding to access preambles, or the one use to respond to CD preambles).

Further we propose that symbols in the same access slot carry identical information and are modulated with either 1+j or –1-j. This means that up to 15 separate status values can be indicated every two frames (or 7 every frame). Repetition can be used if there are less than 15

The precise mapping of status information onto the CSICH should be controlled by Layer 2.

References

[1] TSGR1#7(99)b36, “Performance of CPCH”, Philips
[2] TSGR1#7(99)b77,”CPCH Simulations”, GBT
[3] TSGR1#7(99)b38, “Status information for CPCH”, Philips
[4] TSGR1#7(99)b36, “Enhanced CPCH with status monitoring and code assignment”, Philips

Text Proposal for 25.211

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

<ACRONYM> <Explanation>

AI	Acquisition Indicat~~i~~or
AICH	Acquisition Indication Channel
AP	Access Preamble
BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
CSICH	CPCH Status Indication Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
FACH	Forward Access Channel
FBI	Feedback Information
MUI	Mobile User Identifier
PCH	Paging Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicatior
PICH	Page Indication Channel
PRACH	Physical Random Access Channel
RACH	Random Access Channel
RNC	Radio Network Controller
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SI	Status Indicator
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment

…SNIP….

5.3.3.8 CPCH Status Indication Channel

The CPCH Status Indication Channel (CSICH) is a fixed rate (SF=256) physical channel used to carry CPCH status information.

The CSICH is always associated with an AICH used for transmission of CPCH CD-AICH, and uses the same channelization and scrambling codes.

Figure 2x illustrates the frame structure of the CSICH. Two CSICH frames of total length 20ms consist of 15 access slots (AS) of length 20 symbols (5120 chips). Each access slot consists of two parts: a Status Indicator (SI) and an empty part. The SI symbols are transmitted during the empty part of the associated AICH.

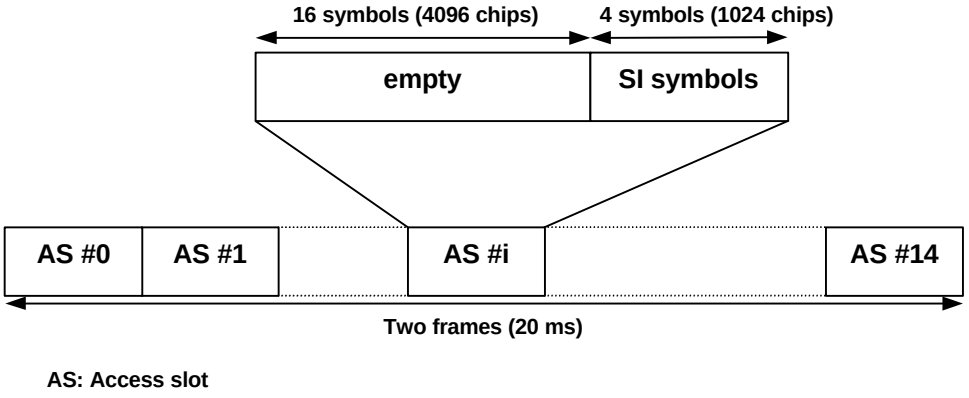

Figure 2x: Structure of CPCH Status Indication Channel (CSICH)

Symbols in the same access slot carry identical status information and are modulated with either 1+j or –1-j. Repetition can be used if there are less than 15 status values to be sent. The phase reference for CSICH is the primary CPICH.

The status values indicate the availability of one or more CPCH channels.

6 Mapping of transport channels onto physical channels

Figure 23 summarises the mapping of transport channels onto physical channels.

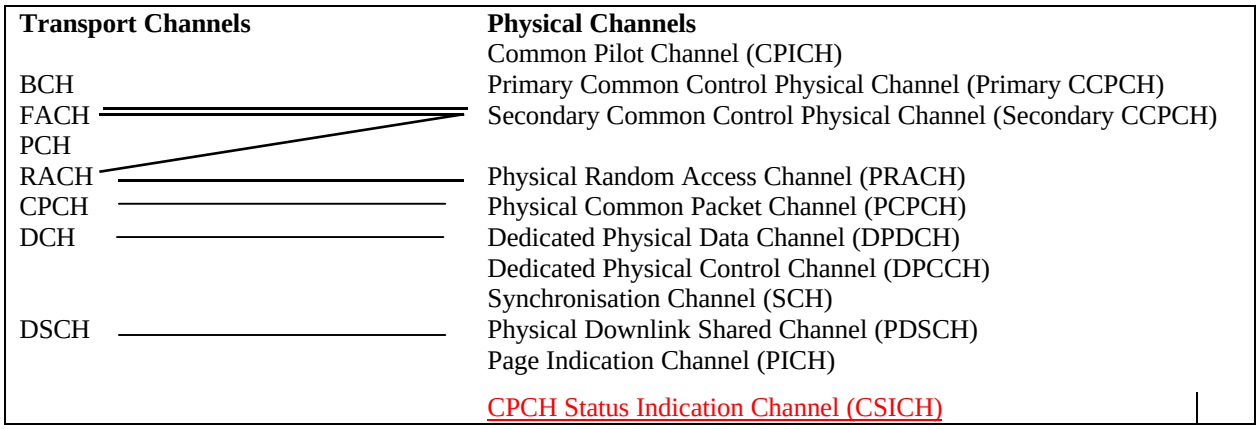

Figure 23: Transport-channel to physical-channel mapping.

The DCHs are coded and multiplexed as described in [3] , and the resulting data stream is mapped sequentially (first-in-first-mapped) directly to the physical channel(s). The mapping of BCH and FACH/PCH is equally straightforward, where the data stream after coding and interleaving is mapped sequentially to the Primary and Secondary CCPCH respectively. Also for the RACH, the coded and interleaved bits are sequentially mapped to the physical channel, in this case the message part of the random access burst on the PRACH.

Text Proposal for 25.213

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AICH Acquisition Indicationor Channel
AP Access Preamble
BCH Broadcast Control Channel
CCPCH Common Control Physical Channel
CD Collision Detection
CPCH Common Packet Channel
CSICH CPCH Status Indication Channel
DCH Dedicated Channel
DPCH Dedicated Physical Channel
DPCCH Dedicated Physical Control Channel
DPDCH Dedicated Physical Data Channel

….SNIP…

5.1 Spreading

Figure 9 illustrates the spreading and modulation for the downlink DPCH. Data modulation is QPSK where each pair of two bits are serial-to-parallel converted and mapped to the I and Q branch respectively. The I and Q branch are then spread to the chip rate with the same channelization code c_{ch} (real spreading) and subsequently scrambled by the scrambling code C_{scramb} (complex scrambling).

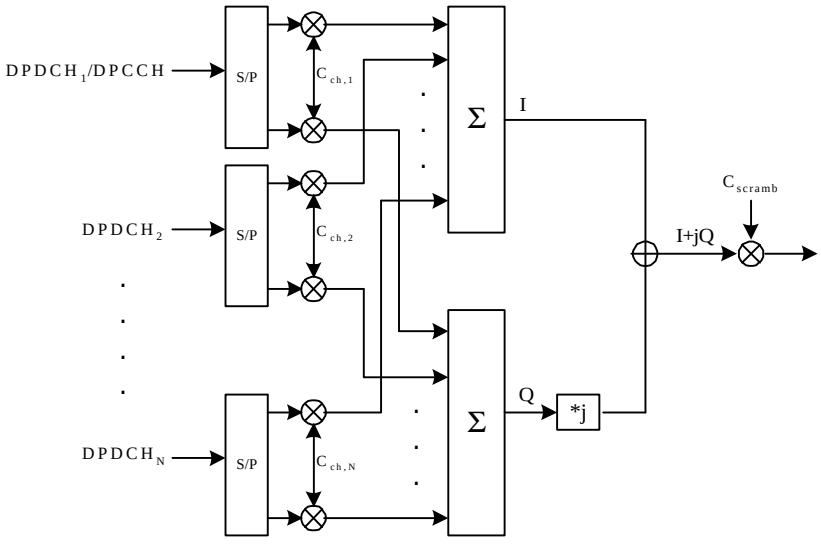

Figure 9. Spreading/modulation for downlink DPCH.

Spreading/modulation of the CPICH, Secondary CCPCH, PSCCCH, PDSCH, PICH,CSICH and AICH is done in an identical way as for the downlink DPCH.