TSG-RAN Working Group 1 meeting #7 *TSGR1-b10/99*
Hannover, August 30 – September 3 1999

Agenda Item: **Adhoc 8**
Source: **Hyundai Electronics & Shinsegi Telecomm.**
Title: **A Scheme for downlink compressed mode using common channel, CMCCH**
Document for: **Approval**

1. Introduction

In the last meeting, Hyundai and Shinsegi proposed a new scheme for compressed mode(CM) which uses CMCCH(Compressed Mode Common Channel) [1]. The new scheme proposed to transmit data through newly defined channel, CMCCH, which SF is the same as that of DPCH in the normal mode. In this document, we will clarify the property of the proposed scheme in detail.

2. CMCCH (Compressed Mode common channel)

UTRAN provides the channel specific information to UE which enters CM. The channel specific information contains OVSF code assigned to CMCCH. The duration of the compressed frame is divided into two parts: idle period and active period. In idle period, UE stops receiving data from cBS (current Base Station) so as to measure the information of tBS (target Base Station). In active period, UE receives the data from cBS through not only CMCCH but also existing dedicated channel.

2.1 Spreading / Modulation for CMCCH

Figure 1 shows the spreading/modulation for a pair of DPCH and CMCCH

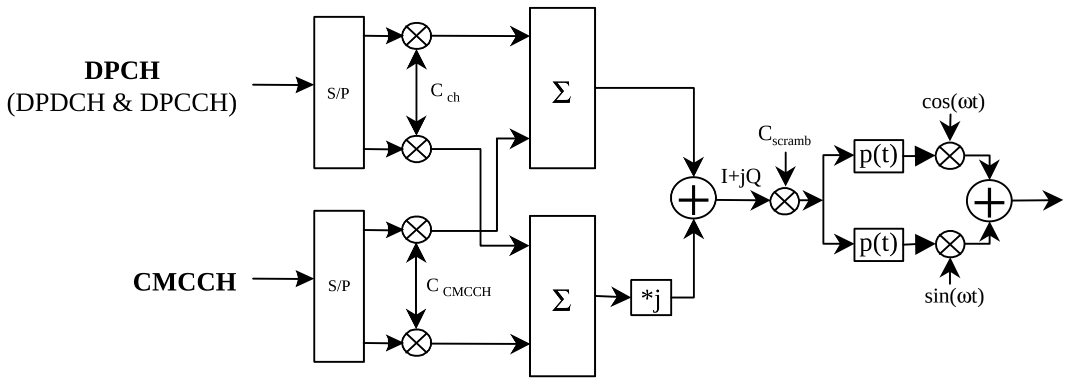

Figure 1. Spreading/modulation for a pair of DPCH and CMCCH

2.2 Channelization code of CMCCH

There have been two proposals about channelization coding method [2][3]. With the OVSF code scheme [2], the code shortage problem may occur even though the orthogonal property is guaranteed. With the scrambling code scheme [3], the code shortage problem is overcome but the violation of orthogonal property may occur.
For each case, the proposed scheme has the following characteristics.

Case 1. OVSF code used for CMCCH
An OVSF code is assigned to CMCCH by a BS and CMCCH will be used when a UE enters CM. In this case, the orthogonal property is guaranteed and CMCCH can be effectively used for the UE whose SF is larger than that of CMCCH, as shown in Table 1. The assigned to CMCCH of a BS may be different from that of neighbor BS's.

SF of UE Who enter CM	4	------	***K***	------	512
Repetition Of OVSF code	This range should be covered by existing methodologies		1	------	512 / ***K***

Table 1. Relationship between SF value for CMCCH and processing range with CMCCH

Case 2. Short scrambling code(SF = 4) used for CMCCH
There have been on-going discussions on the usage of short scrambling code for channelization code. With short scrambling code, CMCCH can be used for all UEs regardless of their SF values. However, it may have a difficulty in

guarantee of orthogonal property.

2.3 SF of CMCCH

A single SF is assigned to CMCCH by BS. If the SF of a UE is larger than that of CMCCH, the assigned channelization code of CMCCH is repeated as shown in table 1. This shows that the SF of CMCCH is varied. Therefore, all UEs in CM communicate through CMCCH if the channelization code of CMCCH has the smallest SF(SF=4)

2.4 CM during SOHO (soft handover)

In the last meeting, there was a question whether the proposed method can support the UE who enter CM during SOHO. Before answering the question, the following problems need to be clarified.

1) The timing difference of CMCCH between BSs which UE is connected to.
2) The difference of SF of CMCCH between BSs which UE is connected to.
3) The processing of multiple CMCCHs by UE.

Problem 1 and 2 are resulted from which the SF and timing of CMCCH are assigned by BS without considering those for neighbor BS's. Although a UE is connected to both BS's during SOHO, the assigned timing and SF of CMCCH may be different between BS's.
In the case of problem 3, when the UE enters CM using CMCCH during SOHO, the UE receives a pair of DPCH and CMCCH from each BS. Hence, the UE should communicate with BS's using 4 channels (2 DPCH + 2 CMCCH).
In general, it is hard to support the CM during SOHO. We proposed the following solutions using CMCCH.

1) In order to resolve the problem of time difference, the channel specific information should be exchanged between BSs before entering CM, such as a position of compressed frame, CM parameter, etc. Given the information, each BS can align the timing of CMCCH.
2) In order to resolve the problem of difference of SF, the code with the smallest SF is used as the channelization code of CMCCH. If the smallest SF for CMCCH is used, the SFs between BSs become same.
3) In order to resolve the problem of processing of multiple CMCCHs by UE, the support of multi-channel DPCH in UEs is to be considered. UE is able to utilize two or more channel if UE supports the DPCH with multi-channel which is shown in [2].

3. Conclusion

As explained above, the proposed scheme can be effectively used for CM utilizing CMCCH, even for CM during SOHO. Furthermore, regardless of channelization code method, the proposed scheme still has several advantages, as explained in the previous meeting [1], such as:

- Ease of maintenance of OVSF code
- Support of any transmission gap without increasing complexity of system
- Ease of transmission of TFCI in a compressed frame

From the above advantages, we strongly recommend that our scheme be used for DL CM.

4. Reference

[1] "New scheme for downlink compressed mode using common channel", TSGR1#6(99)842, Hyundai Electronics & Shinsegi Telecomm, TSG-RAN working Group 1 meeting #6, Espoo, Finland 13-16, July 1999
[2] 3GPP RAN TS 25.213 V2.1.0: "Spreading and modulation (FDD)"
[3] "Slotted mode in UTRA FDD downlink", TSGR1#3(99)175, SONY International (Europe) GmbH, TSG-RAN working Group 1 meeting #3, Eskilstuna, Sweden 22-26, March 1999

5. Text proposal for changes to TS 25.212

4.4.2 Transmission Time Reduction Method

When in compressed mode, the information normally transmitted during a 10 ms frame is compressed in time. The mechanism provided for achieving this is either changing the code rate, which means puncturing in practice, or the reduction of the spreading factor by a factor of two.-The maximum idle length is defined to be 5 ms per one 10 ms frame.

4.4.2.1 Method A1: by Puncturing, basic case

[…(no changes)…]

4.4.2.2 Method A2: By puncturing, for services that allow larger delay

[…(no changes)…]

4.4.2.3 Method B: by Reducing the Spreading Factor by 2

[…(no changes)…]

4.4.2.4 Method C: by Using Common Channel, CMCCH

CMCCH(Compressed Mode Common Channel) is dedicated for compressed mode. The SF of CMCCH is chosen by UTRAN and is informed to the UE when a UE enters compressed mode. If the SF of the UE is larger than SF of CMCCH, the UE uses the repeated code of the channelization code assigned for CMCCH. And several UEs can share the CMCCH, if the DPCHs of those UEs are not overlapped during compressed frame.

During compressed mode, the data of compressed frame are transmitted to UE through a pair of the existing DPCH and CMCCH which size and position are same as one of the DPCH. In CM, the data of compressed frame is transmitted through a pair of DPCH and CMCCH. Use of this method for uplink mode is for further study.

4.4.3 Transmission gap position

Transmission gaps can be placed at both fixed position and adjustable position for each purpose such as interfrequency power measurement, acquisition of control channel of other system/carrier, and actual handover operation.

4.4.3.1 Fixed transmission gap position

[…(no changes)…]

4.4.3.2 Adjustable transmission gap position

[…(no changes)…]

4.4.3.3 Parameters for Compressed Mode

< Editor's note: WG1 suggestion is that there is need for further clarifications in Table 4-1 (e.g. rationales between change of coding rate/puncturing/change of spreading factor and idle time size, spreading factor range for different modes, etc.).>

Table 4-1 shows the detailed parameters for each number of idle slots. This is an example for the 10ms interleaving depth. Application of compressed mode for interleaving depths other than 10ms are for further study. Each number of idle slots are classified for three cases:

Case 1 - Power measurement : Number of idle slots = 3, 4, 5, 6.

Case 2 - Acquisition of control channels : Number of idle slots = 3, 4, 5, 6, 8, 10.

Case 3 - Actual handover operation : Number of idle slots = 10, 16.

Table 4-1. Parameters for compressed *mode <Editors note: Smallest spreading factor used in FDD is 4, thus modification needed for the table below>*

Number of idle slots	Mode	Spreading Factor	Idle length [ms]	Transmission time reduction method	Idle frame Combining
3	A	512 – 256	1.63 – 1.63	Puncturing (S)/(D) CMCCH (S)	
	B	128 – 1	1.63 – 1.75		
4	A	512 – 256	2.25 – 2.25	Puncturing (D) Coding rate reduction:R=1/3->1/2 (S) CMCCH (S)	
	B	128 – 1	2.25 – 2.37		
5	A	512 – 256	2.87 – 2.87		
	B	128 – 1	2.87 – 2.99		
6	A	512 – 256	3.50 – 3.50	Puncturing (D)Spreading factor reduction by 2 (S) CMCCH (S)	
	B	128 – 2/1	3.50 – 3.62		
8	A	512 – 256	4.75 – 4.75	R=1/3->1/2(D) Spreading factor reduction by 2 (S) CMCCH (S)	

	B	128 – 2/1	4.75 – 4.87		
10	A	512 – 256	6.00 – 6.00	Coding rate reduction: R=1/3->1/2	(D)
	B	128 – 1	6.00 – 6.12		
16	A	512 – 256	9.75 – 9.75	Spreading factor reduction by 2	
	B	128 – 2	9.75 – 9.87		

(S): Single-frame method as shown in Figure 4-1 (1).
(D): Double-frame method as shown in Figure 4-1 (2).
SF=“2/1”: “2” is for (S) and “1” is for (D).]