TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3) **TSGR2#3(99)219**
Yokohama 13th to 16th April 1999

Agenda Item: 7.1

Source: LG Information and Communications, Ltd. KOREA[1]

Title: New Transport channels for point-to-multipoint data transmission

Document for: Discussion and Decision

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1. Introduction

In our proposal [1] presented at the last WG2 meeting (meeting #2), two new transport channels for Point-to-Multipoint (PtoM (e.g., multicast)) application are introduced. Moreover, one new physical channel was also proposed since no existing physical channel seemed to meet the requirement for the PtoM transport channels proposed. As a matter of fact, at the recent WG1 meeting (meeting #3), it seems that the secondary CCPCH will be changed in such a way that TFCI is included in its slot structure (refer to LS from WG1 [2]). In that case, no new physical channel is needed for PtoM transport channels. However, there is still a necessity of having new transport channels for PtoM application.

In this proposal, we provide the justification of having new transport channels, namely, **Downlink Shared Common Channel** (DSCCH) and **DSCCH control channel**. Notice that the names have been changed since we introduced them at the last meeting.

2. Characteristics of Point-to-Multipoint (PtoM) Services

2.1 A PtoM Application – Multimedia Distribution Service (MDS) Without User Control

In the current 3GPP TSG SA specifications, particularly [3] or UMTS 22.01(service aspects; service principles), there is a section describing the principles for new UMTS service capabilities (Section 5). Under that section, the following multimedia service capability is currently described:

Multimedia Distribution Services without user control – this is a broadcast services where information is supplied by a central source and where the user can access the flow of information without any ability to control the start or order of presentation e.g., television or audio broadcast services.

Meanwhile, according to [4] or UMTS 22.05 (services and service capabilities), Multicast topology is supposed to be supported.

2.2 Traffic Characteristics of MDS

Since we are dealing with multimedia traffic in MDS types of application, the expected traffic characteristics are as follows:

- medium or high bit rate
- variable rate
- QOS requirements in terms of delay, loss, jitter, etc.

2.3 Any Other PtoM Applications?

We can think of the following applications:

- General Services requiring Point to Multipoint topology

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- Broadcast type SMS

3. Why New Transport Channel for PtoM Service?

3.1 Definition of Transport Channel

The definition of transport channel is as follow:

Transport Channel: The channels offered by the physical layer to Layer 2 for data transport between peer L1 entities are denoted as Transport Channels. Different types of transport channels are defined by how and with which characteristics data is transferred on the physical layer, e.g. whether using dedicated or common physical channel are employed.

Based upon the definition above, we can characterize the existing downlink transport channels as follows:

Transport Channel	How data is transferred?	With which characteristics data is transferred?
BCH	Broadcast/common	Information
PCH	Broadcast/common	Information
FACH	Broadcast/shared	Signaling plus Small traffic
DSCH	shared	Traffic
DCH	dedicated	Traffic

[Table 1 Comparison between transport channels]

3.2 Characteristics which Transport Channel for PtoM service has to have

Given that we support MDS types of applications, and also considering the characteristics of those service and the traffic, we concluded that we need a new transport channel, namely, *Downlink Shared Common Channel* or **DSCCH** in short. The following subsections provide necessary justification.

3.2.1 Multicast

Considering the characteristics of MDS types of applications, it is natural to consider Multicast topology since not every user want to subscribe to all MDS service being provided. This service should be served based on user subscription.

3.2.2 Shared

Again, Fat Pipe

Imagine a situation where multiple MDSs are served simultaneously. One brute force way is to use multiple point-to-point delivery using DCH for each MDS. However, considering the traffic characteristics, this is highly undesirable in terms of code usage or channel usage. If we recall the rationale of DSCH, the biggest advantage of DSCH is efficient resource utilization by sharing radio resources among users. The same logic can be applied to the case of providing multiple simultaneous MDS instances.

3.2.3 Common

The same logic described in 3.4.1 above can be applied. Multicast topology means there are more than two recipients for one MDS stream. Therefore, we need a “common” channel.

3.3 Why not FACH ?

One may argue that FACH can be used for MDS types of applications. However, FACH is mainly designed for signaling information delivery, not for serious user traffic delivery. On top of that, considering multimedia traffic characteristics (medium or high bit rate and bursty) together with QOS required, FACH is not appropriate.

3.4 Why not DSCH?

DSCH was introduced for efficient bursty packet transmission. Even if DSCH seems to provide the similar functionality that we want to provide for MDS types of application, DSCH has different implications. That is, DSCH is basically for the situation where uplink and downlink traffics are generated asymmetrically. This situation implies two way connections. Whereas, we only need downlink connection for MDS types of application. Moreover, DSCH doesn't seem to have the same feature as "common" channel has. This is because DSCH is normally used for point-to-point connection, and multiple users shares this channel.

3.5 Proposed Transport Channel –DSCCH

Based upon the justifications above, we propose a new transport channel, namely Downlink Shared Common Channel, which has the following characteristics:

- downlink only
- multicast topology
- shared among groups of users
- fast rate change
- no power control
- serious user multimedia traffic delivery
- possibility of sleep mode operation

4. Other Characteristics of MDS from transport perspective

1) Non-periodic

Scheduling of a lot of point-to-multipoint service makes the PTM data to be transmitted non-periodic way. Furthermore because shortage of downlink channelization codes, even though bit rate changes fast by frame by frame basis, a lot of codes may not be assigned for the PTM service. That means PTM service could be transmitted non-periodic way.

2) Sleep mode (Group identification)

UEs do not want to receive of non-interest data with it. Moreover, for better battery usage, it must be able to identify those data from others without decoding all..

3) Fast Rate Change

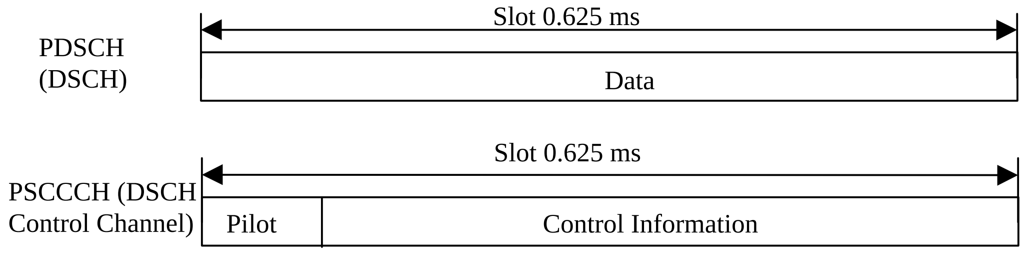
In 3G future system, Various data, e.g. multimedia or complex data form would be served in wireless mobile communication. Therefore, it should have possibility of fast rate change.

5. Physical Channel for DSCCH

5.1 What about PDSCH and PSCCCH?

PDSCH & PSCCCH (DSCH is always associated with DSCH Control Channel when there is no DCH)

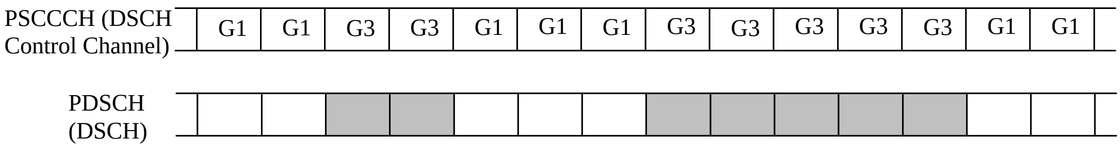
The physical structures are as follows:



[Figure 1 Structure of PDSCH and PSCCCH]

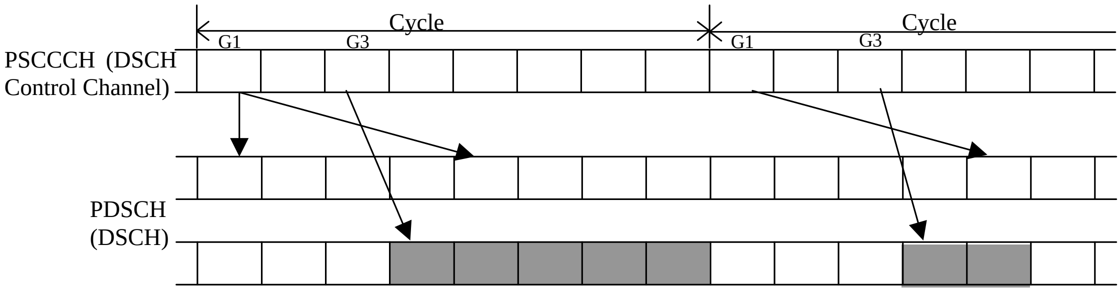
In figure x control information would be code assignment for the PDSCH (or TFCI) (and optionally in case 2-2) Starting point and ending point of data on PDSCH). PDSCH uses the pilot symbol of PSCCCH.

Case A) In case of not using cycle for control channel, UE cannot get into sleep mode, data can be transmitted by a non-periodic way. (Because UE decodes all data on PSCCCH) data rate per frame is variable.



[Figure 2 Example of Case A using PDSCH and PSCCCH]

Case B) In case of using cycle for control channel, UE may get into sleep mode, data rate between burst is variable, while data rate during burst is constant.data can be transmitted by a non-periodic way.

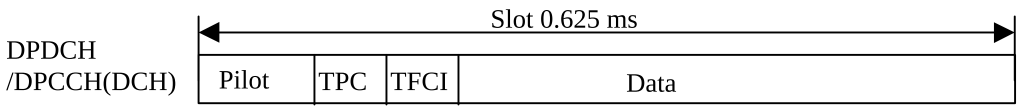


[Figure 3 Example of Case A using PDSCH and PSCCCH]

Using PDSCCH and PSCCCH, PTM data can be transmitted by a non-periodic way. However, when UE can get into sleep mode , then it cannot change rate during within one burst. Meanwhile, if UE give up sleep mode operation, it can change rate during within one burst.

What about DPDCH/DPCCH (downlink)?

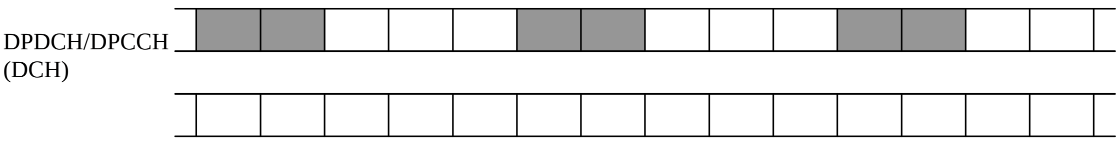
5.2



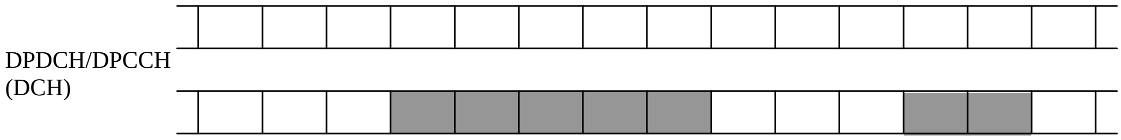
[Figure 4 Structure of DPDCH/DPCCH]

Case A) PTM data is transmitted periodically, data rate is variable. UE may get into sleep mode

[Figure 5 Example of Case A using PDSCH and PSCCCH]



Case B) PTM data is transmitted non-periodically, data rate is variable, UE decodes all PTM data for group identification



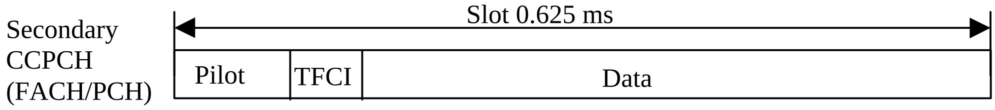
[Figure 6 Example of Case B using DCH]

For point-to-multipoint data transmission, DPDCH and DPCCH could be used. PTM data is transmitted periodically while UE can get into sleep mode in both cases. Otherwise, UE cannot get into sleep mode in non-periodical way. Data rate per frame is variable, because there is CI field in each frame. ***What is TPC field for? (TPC field must be considered)***

6. Channel Structures for DSCCH

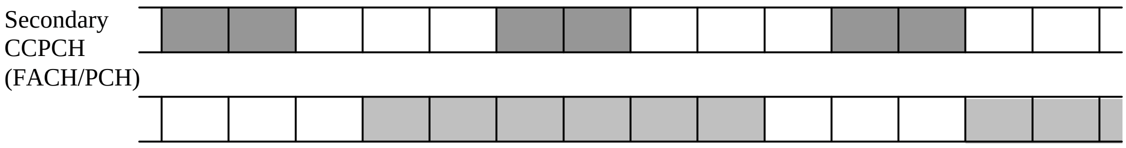
6.1 Physical Channel for DSCCH – Secondary CCPCH

According to [2], Secondary CCPCH now provides fast bit rate change (each 10ms) thanks to TFCI field. If we don't use any new transport channel, following cases could be considered.



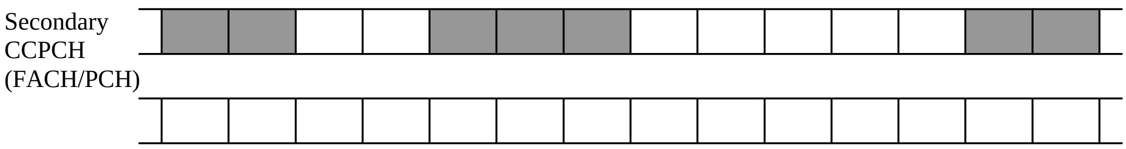
[Figure 7 Structure of Secondary CCPCH]

Case A) PTM data is transmitted periodically, UE may get into sleep mode



[Figure 8 Example of Case A using Secondary CCPCH]

Case B) PTM data is transmitted non-periodically, UE decodes all PTM data for group identification



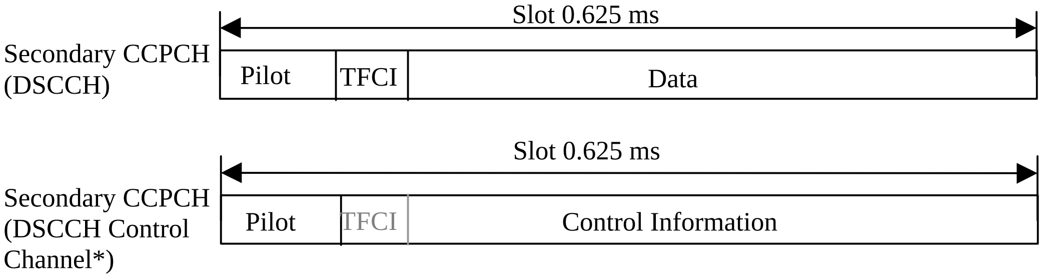
[Figure 9 Example of Case B using Secondary CCPCH]

However, any of both cases cannot be operated in a non-periodic way with sleep mode. This motivates us to introduce an additional channel for the control of DSCCH. We present this in the next section.

6.2 Proposed Control Channel for DSCCH – DSCCH Control Channel

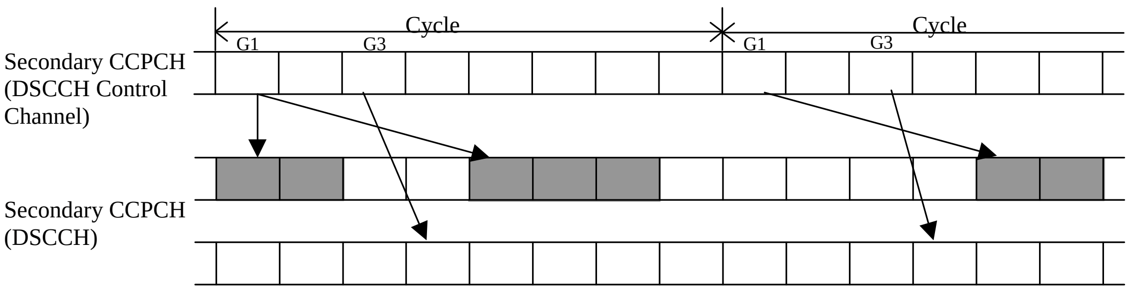
In this and previous proposal, we also propose a separate control channel for DSCCH, namely DSCCH Control channel. This channel is introduced to provide the flexibility in operation of DSCCH. For example, we can easily implement sleep mode operation using this control channel. Also, we can inform UEs about the scheduling information between different MDS streams. The detailed operation is described in the previous proposal.

[Figure 10 Physical Channel Structure of DSCCH and DSCCH Control Channel]



Control Channel may be Secondary CCPCH. Control information on DSCCH Control Channel is code assignment for DSCCH and starting point and ending point of them. and other information PTM data is non-periodically with DSCCH Control Channel, while UE can get into sleep mode. Data rate between bursts is variable. Data rate during one burst is variable, as well.

[Figure 11 Example of PtoM Service using proposed channels]



7. Proposed changes

7.1 Transport Channel – Downlink Shared Common Channel (DSCCH)

Based upon the justifications above, we propose a new transport channel, namely DSCCH. The characteristics of this channel is as follows:

- downlink only
- multicast topology
- shared among groups of users
- fast rate change
- no power control
- serious user multimedia traffic delivery
- possibility of sleep mode operation

7.2 Transport Channel –DSCCH Control Channel

Based upon the justifications above, we propose a new transport channel, namely DSCCH Control Channel. The characteristics of this channel is as follows:

- downlink only
- shared among groups of users

- no power control
- DSCCH control information delivery
- possibility of sleep mode operation

8. Conclusion

In this proposal, we presented the necessity of having two new transport channels, namely, Downlink Shared Common Channel (DSCCH) and DSCCH Control Channel for the provision of general Point-to-Multipoint type application, e.g., Multimedia Distribution Service without user control.

9. References

[1] LG Information and Communications, “Definitions and Characteristics of Multicast Channels”, Tdoc 76, 3GPP TSG RAN WG2, Stockholm, 1999.

[2] TSG RAN WG1, “Liaison Statement to WG2: Physical Channel for FACH”, Tdoc 325, 3GPP TSG RAN WG1, Nynashamn, 1999

[3] TSG SA, UMTS 22.01 Service Aspects; Service Principles, 1999

[4] TSG SA, UMTS 22.05 Service and Service Capabilities, 1999