TSG-RAN Working Group 1(Radio) meeting #3 ***TSGW1#3(99)200***

Eskilstuna, Sweden 22-26, March 1999

Agenda Item: 9.1 (New Contributions, Transport/Physical Channels (FDD))

Source: LG Information & Communications, Ltd. KOREA

Title: A Proposal for A New Channel – Downlink Shared Common Channel for Point-to-Multipoint (PTM) Connection

Document for: Discussion and Decision

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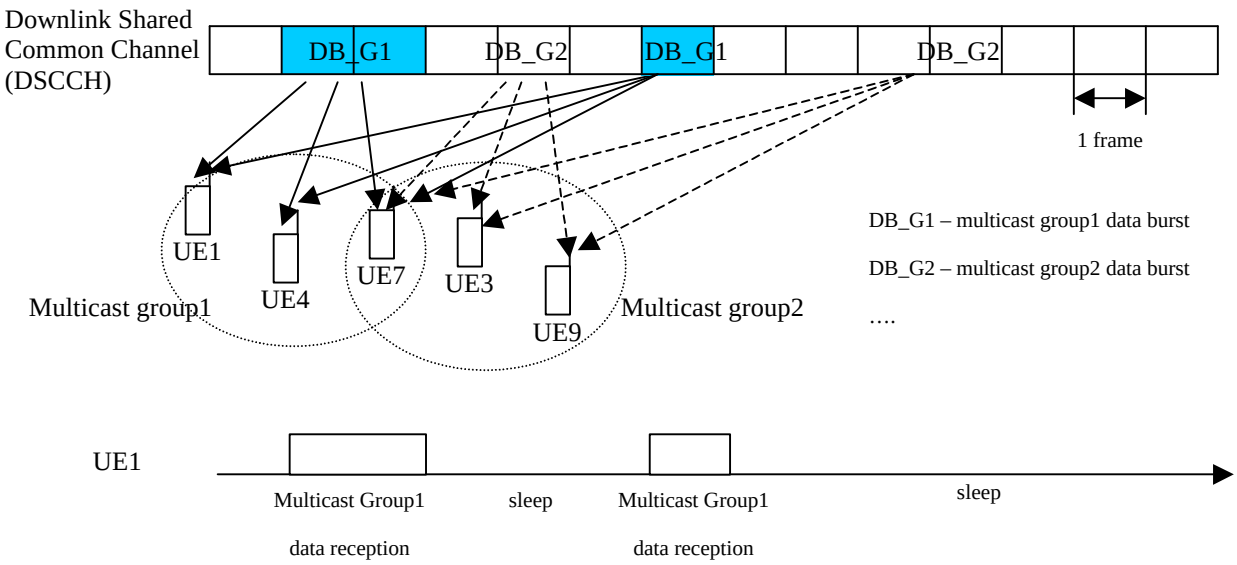
1. Introduction

In this contribution, we consider unidirectional point-to-multipoint (PTM) data transmission over air interface, particularly group based multicast data transmission. Current PTM service between networks and mobile terminals requires PTM connections over air interface. This implies a different way of downlink channel usage among UEs, i.e., **groups of UEs share a common channel** (refer to figure 1 below). Based upon this rationale, we propose two new transport channels, namely, ***Downlink Shared Common Channel*** (**DSCCH**) and **DSCCH control** channel, and one physical channel, **PDSCCH**, for PTM connection.

Figure 1. Multicast type Point-to-Multipoint (PTM) Data Transmission / Reception Example



2. Problems of existing channels for PTM type connection

Some anticipated characteristics of multicast type PTM service from physical layer perspective:

a. Group identification based UE addressing and efficient data reception at UE side

b. Multimedia Traffics requiring Variable Low/Medium data rate (e.g., newscast)

c. Quality of Service (QOS) Guarantee in terms of delay, throughput, and etc.

d. No power control

e. Unidirectional

By efficient data reception at UE side above, we mean that UE gets into sleep mode while the transmission of other group's multicast data is on going. In order to support this sleep mode, UE has a capability of selected data extraction. This means that layer 23 or signaling based UE addressing should be prohibited.

Power control is not required for multicast service, because it is a unidirectional PTM service, in which multiple UEs use the same common radio link for data reception.

Having the characteristics or requirements described above, let us check if any one of existing channels can meet the requirements.

1) BCH or FACH

BCH does not provide data rate change because it has fixed data rate such as 32kbps(SF=256). FACH doesn't seem to provide data rate change, either at this moment because it is mapped to the Secondary CCPCH, which has a constant rate in a cell.

2) DCH

Obviously, this channel requires power control.

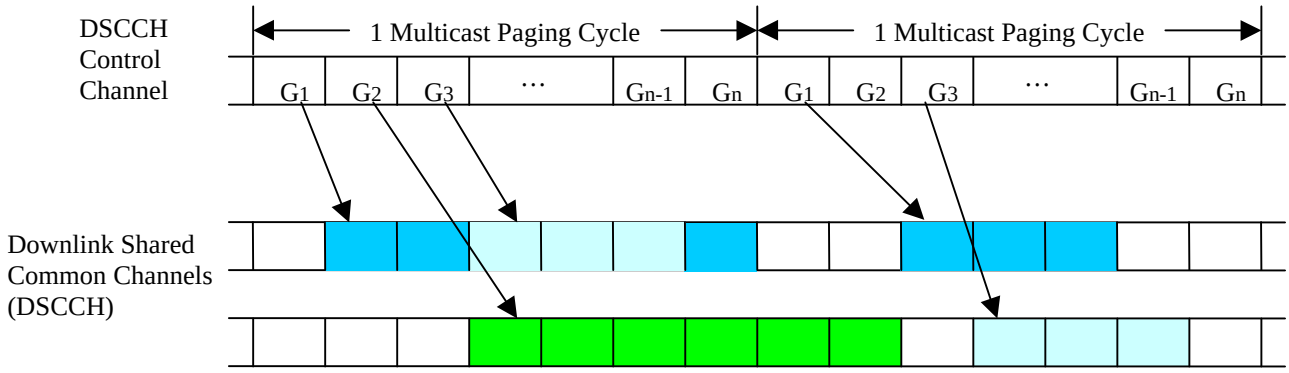
3) DSCH

DSCH is virtually a point-to-point connection at any moment of time.

Consequently, at this moment we do not seem to have a channel for multicast type PTM connections.

3. New Transport Channels for Multicast type PTM connection – Downlink Shared Common Channel (DSCCH) and DSCCH Control Channel

Figure 2 shows an example of the transmission and reception of multicast type PTM data using the newly introduced transport channel, **Downlink Shared Common Channel** (DSCCH) together with its control channel (DSCCH Control Channel). DSCCH Control channel is similar to the current Paging Channel in that it has a cycle as shown in the figure. This period is determined by the number of multicast groups being served.



G1 – Pointer of the next multicast group1 data burst

G2 – Pointer of the next multicast group2 data burst

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[Figure 2 Multicast service scenario using DSCCH and DSCCH Control channel]

Notice that there is only one DSCCH Control channel while there could be multiple DSCCHs. UE can know when to decode the PTM data burst from the control information being delivered over DSCCH Control channel. This control information indicates the starting point of PTM data burst, the length of the PTM data burst, and some other information.

Multicast data reception procedures are as follows:

1) UE knows when to listen to DSCCH Control Channel based on the knowledge of the period, which is regularly broadcast on BCH.

2) If the PTM data is available, the user decodes only the frame belongs to the user group from the DSCCH Control Channel (Cyclic period).

3) User decodes PTM data being transmitted on Downlink Shared Common Channel (DSCCH) using the information received from DSCH Control Channel indicating the location of PTM data and duration.

4) Repeats 2) and 3)

4. Physical Channels for Downlink Shared Common Channel (DSCCH) and DSCCH Control Channel

One PTM data burst on Downlink Shared Common Channel (DSCCH) can be transmitted across consecutive frames. Therefore, Pilot is required in the physical channel for DSCCH to perform channel estimation. Meanwhile, because the data rate of DSCCH can vary frame by frame basis, TFCI information is also needed. As described in the previous section, power control is not needed.

Let us check if any existing physical channel meets these requirements for DSCCH.

1) DPCH (DPDCH/DPCCH) - It is not appropriate because it has TPC field.

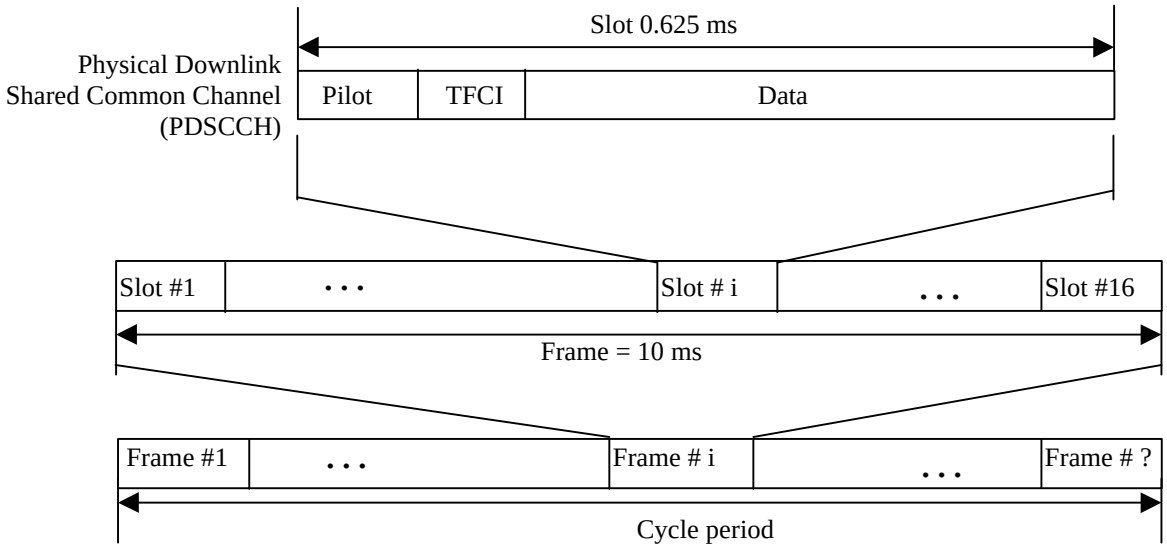
2) Secondary CCPCH and PSCCCH - They are not suitable, because they cannot provide fast rate change.

3) PDSCH - It has no pilot and no support for fast rate change.

Consequently, we need a new physical channel for DSCCH. This channel will be called *Physical DSCCH*, **PDSCCH** in short.

Considering the characteristics for DSCCH Control Channel, Secondary CCPCH seems to be suitable because DSCCH Control channel does not require rate change rate and any uplink to be power controlled.

The figure 3 shows the physical channel format for PDSCCH.



[Figure 3 PDSCCH Physical Channel Structure]

TFCI information may be contained either in the physical channel for DSCCH Control Channel or in Physical Downlink Shared Common Channel (PDSCCH) depending on whether the PTM data rate changes rapidly or slowly. If the PTM data rate changes frame by frame basis, the TFCI field must be included in the Physical Downlink Shared Common Channel (PDSCCH). Whereas TFCI field must be included in the physical channel for DSCCH Control Channel if the PTM data rate does not change during PTM data burst transmission in a cycle. However, it looks more flexible and reasonable to put TFCI into the Physical Downlink Shared Common Channel (PDSCCH) at this moment.

5. Proposed modifications

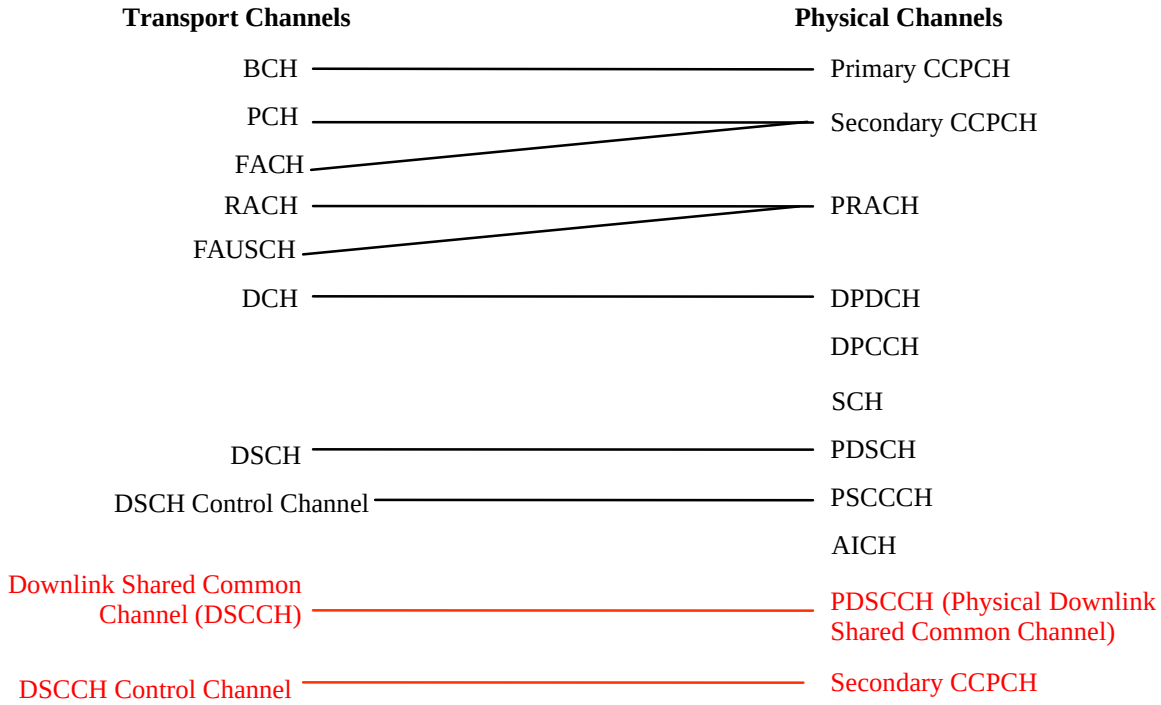
- Addition of two new transport channels, which are as follows:

1) **Downlink Shared Common Channel (DSCCH)** – A downlink channel shared by several UE groups for PTM data delivery.

2) **DSCCH Control Channel -** A downlink broadcast channel used for DSCCH control.

- Addition of one new physical channel, **Physical Downlink Shared Common Channel (PDSCCH), and its structure as shown in Figure 3.**

- The **mapping** to be modified is shown below:



[Figure 4 Updated Mapping between transport channels and physical channels]

7. Reference

[1] 3GPP S21.11 UTRA FDD; Transport channels and physical channels

[2] 3GPP S2.01, Radio Interface Protocol Architecture

[3] 3GPP S2.02 Services provided by the physical layer

[4] GSM 01.60 Version 6.0.0 Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Requirements specification of GPRS

[5] GSM 02.60 Version 7.0.0 Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 1