WCDMA FOR UMTS

Radio Access For Third Generation
Mobile Communications

Revised edition

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This chapter has been divided as follows. First, the transport channels are described together with their mapping to different physical channels in Section 6.2. Spreading and modulation for uplink and downlink are presented in Section 6.3, and the physical channels for user data and control data are described in Sections 6.4 and 6.5. In Section 6.6 the key physical layer procedures, such as power control and handover measurements, are covered.

6.2   Transport Channels and their Mapping to the Physical Channels

In UTRA the data generated at higher layers is carried over the air with transport channels, which are mapped in the physical layer to different physical channels. The physical layer is required to support variable bit rate transport channels to offer bandwidth-on-demand services, and to be able to multiplex several services to one connection. This section presents the mapping of the transport channels to the physical channels, and how those two requirements are taken into account in the mapping.

Each transport channel is accompanied by the Transport Format Indicator (TFI) at each time event at which data is expected to arrive for the specific transport channel from the higher layers. The physical layer combines the TFI information from different transport channels to the Transport Format Combination Indicator (TFCI). The TFCI is transmitted in the physical control channel to inform the receiver which transport channels are active for the current frame; the exception to this is the use of Blind Transport Format Detection (BTFD) that will be covered in connection with the downlink dedicated channels. The TFCI is decoded appropriately in the receiver and the resulting TFI is given to higher layers for each of the transport channels that can be active for the connection. In Figure 6.1 two transport channels are mapped to a single physical channel, and also error indication is
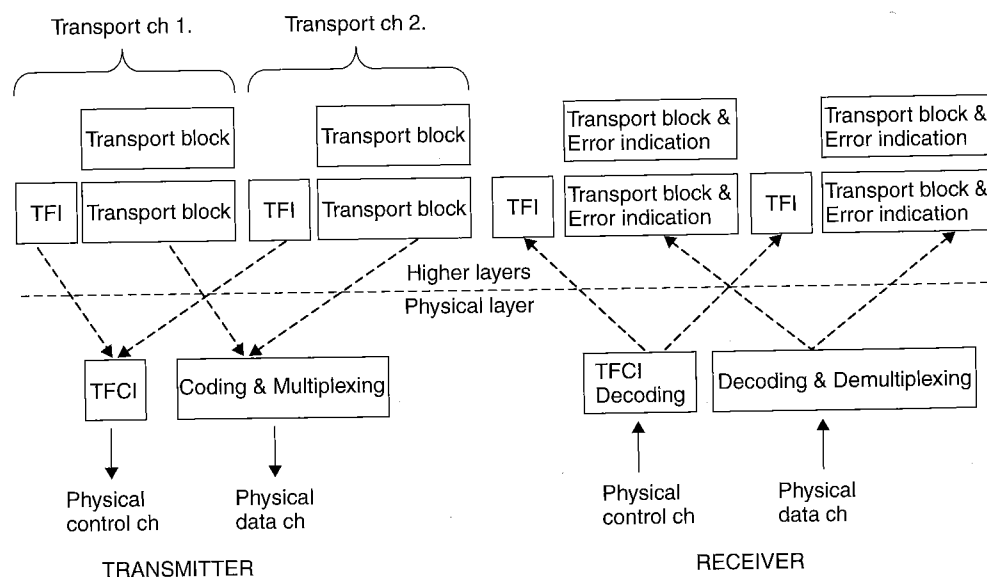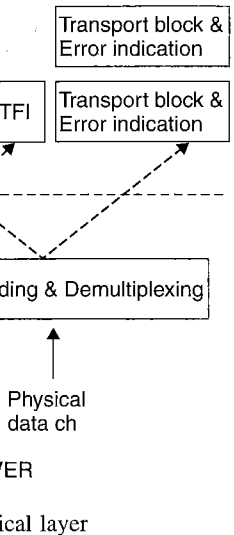

Figure 6.1. The interface between higher layers and the physical layer

provided for each transport block. The transport channels may have a different number of blocks and at any moment not all the transport channels are necessarily active.

One physical control channel and one or more physical data channels form a single Coded Composite Transport Channel (CCTrCh). There can be more than one CCTrCh on a given connection but only one physical layer control channel is transmitted in such a case.

The interface between higher layers and the physical layer is less relevant for terminal implementation, since basically everything takes place within the same equipment, thus the interfacing here is rather a tool for specification work. For the network side the division of functions between physical and higher layers is more important, since there the interface between physical and higher layers is represented by the Iub-interface between the base station and Radio Network Controller (RNC) as described in Chapter 5. In the 3GPP specification the interfacing between physical layer and higher layers is covered in [6].

Two types of transport channels exist: dedicated channels and common channels. The main difference between them is that a common channel is a resource divided between all or a group of users in a cell, whereas a dedicated channel resource, identified by a certain code on a certain frequency, is reserved for a single user only. The transport channels are compared in Section 10.3 for the transmission of packet data.

6.2.1 Dedicated Transport Channel

The only dedicated transport channel is the dedicated channel, for which the term DCH is used in the 25-series of the UTRA specification. The dedicated transport channel carries all the information intended for the given user coming from layers above the physical layer, including data for the actual service as well as higher layer control information. The content of the information carried on the DCH is not visible to the physical layer, thus higher layer control information and user data are treated in the same way. Naturally the physical layer parameters set by UTRAN may vary between control and data.

The familiar GSM channels, the traffic channel (TRCH) or associated control channel (ACCH), do not exist in UTRA physical layer. The dedicated transport channel carries both the service data, such as speech frames, and higher layer control information, such as handover commands or measurement reports from the terminal. In WCDMA a separate transport channel is not needed because of the support of variable bit rate and service multiplexing.

The dedicated transport channel is characterised by features such as fast power control, fast data rate change on a frame-by-frame basis, and the possibility of transmission to a certain part of the cell or sector with varying antenna weights with adaptive antenna systems. The dedicated channel supports soft handover.

6.2.2 Common Transport Channels

There are currently six different common transport channel types defined for UTRA, which are introduced in the following sections. There are a few differences from second generation systems, for example transmission of packet data on the common channels, and a downlink shared channel for transmitting packet data. Common channels do not have soft handover but some of them can have fast power control.