LTE COMMUNICATION CHANNELS

The information flows between the different protocols are known as channels and signals. LTE uses several different types of logical, transport and physical channel, which are distinguished by the kind of information they carry and by the way in which the information is processed.

- **Logical Channels** : Define **whattype** of information is transmitted over the air, e.g. traffic channels, control channels, system broadcast, etc. Data and signalling messages are carried on logical channels between the RLC and MAC protocols.
- **Transport Channels** : Define **howis** something transmitted over the air, e.g. what are encoding, interleaving options used to transmit data. Data and signalling messages are carried on transport channels between the MAC and the physical layer.
- **Physical Channels** : Define **whereis** something transmitted over the air, e.g. first N symbols in the DL frame. Data and signalling messages are carried on physical channels between the different levels of the physical layer.

Logical Channels

Logical channels define what type of data is transferred. These channels define the data-transfer services offered by the MAC layer. Data and signalling messages are carried on logical channels between the RLC and MAC protocols.

Logical channels can be divided into control channels and traffic channels. Control Channel can be either common channel or dedicated channel. A common channel means common to all users in a cell *Pointtomultipoint* while dedicated channels means channels can be used only by one user *PointtoPoint*.

Logical channels are distinguished by the information they carry and can be classified in two ways. Firstly, logical traffic channels carry data in the user plane, while logical control channels carry signalling messages in the control plane. Following table lists the logical channels that are used by LTE:

Channel Name	Acronym	Control channel	Traffic channel
Broadcast Control Channel	BCCH	X	
Paging Control Channel	PCCH	X	
Common Control Channel	CCCH	X	
Dedicated Control Channel	DCCH	X	
Multicast Control Channel	MCCH	X	
Dedicated Traffic Channel	DTCH		X
Multicast Traffic Channel	MTCH		X

Transport Channels

Transport channels define how and with what type of characteristics the data is transferred by the physical layer. Data and signalling messages are carried on transport channels between the MAC and the physical layer.

Transport Channels are distinguished by the ways in which the transport channel processor manipulates them. Following table lists the transport channels that are used by LTE:

Channel Name	Acronym	Downlink	Uplink
Broadcast Channel	BCH	X	
Downlink Shared Channel	DL-SCH	X	
Paging Channel	PCH	X	
Multicast Channel	MCH	X	
Uplink Shared Channel	UL-SCH		X
Random Access Channel	RACH		X

Physical Channels

Data and signalling messages are carried on physical channels between the different levels of the physical layer and accordingly they are divided into two parts:

- Physical Data Channels
- Physical Control Channels

Physical data channels

Physical data channels are distinguished by the ways in which the physical channel processor manipulates them, and by the ways in which they are mapped onto the symbols and sub-carriers used by Orthogonal frequency-division multiplexing $OFDMA$. Following table lists the **physical data channels** that are used by LTE:

Channel Name	Acronym	Downlink	Uplink
Physical downlink shared channel	PDSCH	X	
Physical broadcast channel	PBCH	X	
Physical multicast channel	PMCH	X	
Physical uplink shared channel	PUSCH		X
Physical random access channel	PRACH		X

The **transport channel** processor composes several types of control information, to support the low-level operation of the physical layer. These are listed in the below table:

Field Name	Acronym	Downlink	Uplink
Downlink control information	DCI	X	
Control format indicator	CFI	X	
Hybrid ARQ indicator	HI	X	
Uplink control information	UCI		X

Physical Control Channels

The transport channel processor also creates control information that supports the low-level operation of the physical layer and sends this information to the physical channel processor in the form of physical control channels.

The information travels as far as the transport channel processor in the receiver, but is completely invisible to higher layers. Similarly, the physical channel processor creates physical signals, which support the lowest-level aspects of the system.

Physical Control Channels are listed in the below table:

Channel Name	Acronym	Downlink	Uplink
Physical control format indicator channel	PCFICH	X	
Physical hybrid ARQ indicator channel	PHICH	X	
Physical downlink control channel	PDCCH	X	
Relay physical downlink control channel	R-PDCCH	X	
Physical uplink control channel	PUCCH		X

The base station also transmits two other physical signals, which help the mobile acquire the base station after it first switches on. These are known as the primary synchronization signal PSS and the secondary synchronization signal SSS.