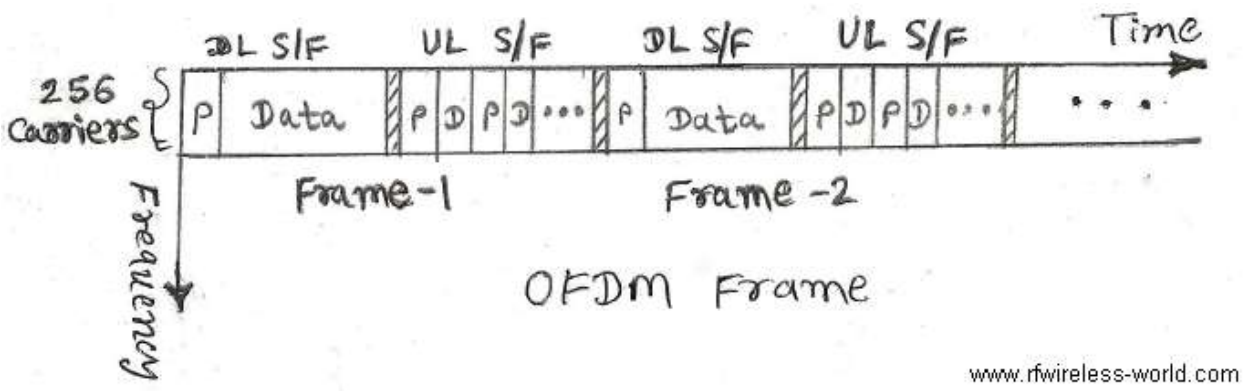
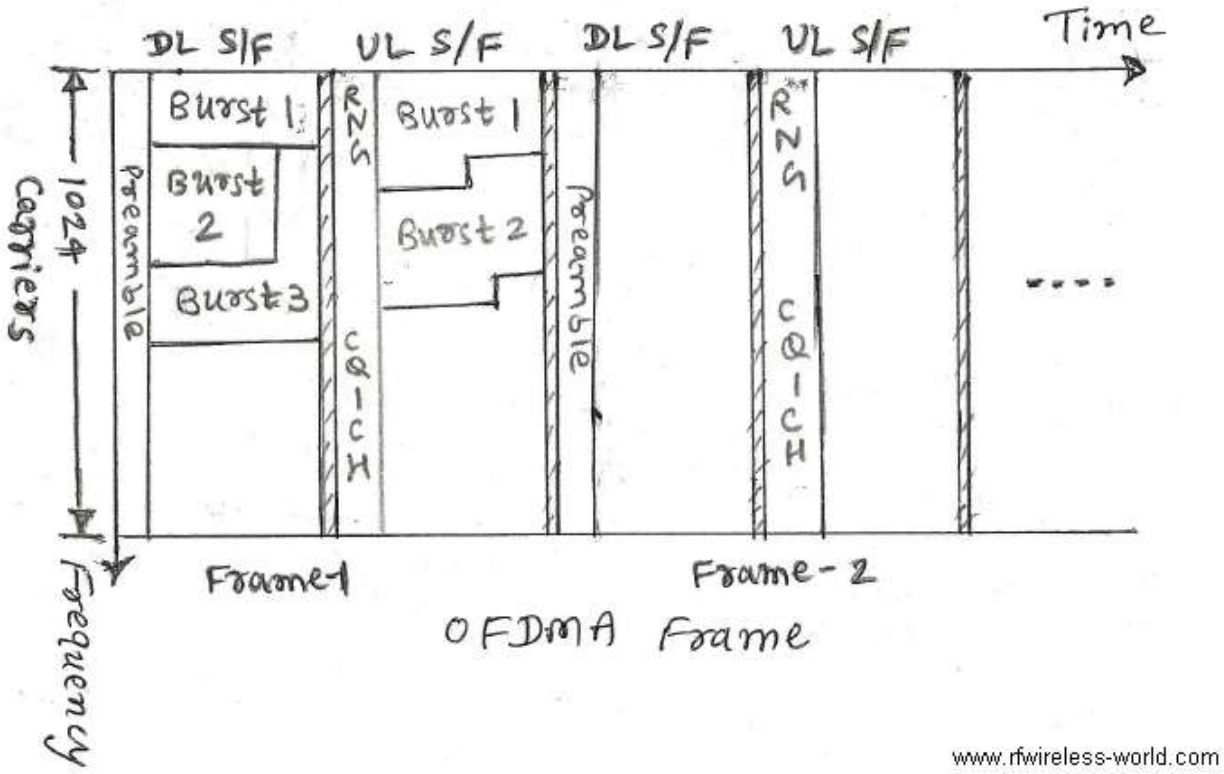
OFDM versus OFDMA

In **OFDM** systems, only a single user can transmit on all of the sub-carriers at any given time. In order to support multiple users time and/or frequency division access techniques are used in OFDM. The major setback to this static multiple access scheme is the fact that the different users see the wireless channel differently is not being utilized. OFDMA, on the other hand, allows multiple users to transmit simultaneously on the different sub-carriers per OFDM symbol. OFDM is employed in Fixed WiMAX system deployed around the world for broadband internet service. Figure 1 depicts OFDM frame structure employed in fixed WiMAX system. Here Downlink sub frame is transmitted by Base station to subscriber stations and Uplink sub frame is transmitted by multiple subscriber stations to the Base Station. Both the frame is composed of more than one OFDM symbols and each symbol is made up of subcarriers, which fall in data and pilot subcarriers, where data subcarriers carry the user data. There are 192 data sub carriers in Fixed WiMAX System. The point here is Subscriber station has been assigned one or more symbols by BS and all the data carriers of the symbols are occupied by one SS. It is depicted in the figure that entire 256 carriers are allocated to the user at its predetermined time slot in TDD frame.



In the case of **OFDMA**, which is employed in Mobile WiMAX system deployed around the world and also employed in LTE system being deployed, total subcarriers are permuted and assigned to sub channel. Hence many SSs can occupy the same sub channel but use different subcarriers to transmit the information. Figure 2 describes OFDMA frame used in Mobile WiMAX System. It clearly mentions that one symbol is composed of more than one sub channel and each sub channel is composed of distributed subcarriers. The point here is each symbol is used by more number of SSs to transmit and receive the information which is depicted by Burst 1 and Burst 2 in the figure. As mentioned in OFDMA subcarriers are divided among users at the same time instant. Figure mentions 1024 FFT case here.



The Frame structures mentioned here only for demonstrating the concept and it differs in the actual wimax system.

Both OFDM and OFDMA is used to achieve high data rate transmission over the air. With OFDMA system can support more subscribers with sub channelization concept compare to OFDM.

Both OFDM and OFDMA is implemented using IFFT and FFT operation at transmitter and receiver respectively. For OFDM entire input of IFFT is occupied fully by either subscriber station or Base Station. For OFDMA part of input values (consecutively) is occupied by Subscriber station and at rest of the inputs zeros or nulls are inserted. Same is done with other subscribers and so on.

RELATED LINKS

OFDM Physical layer
OFDMA Physical layer