

OFDM

Orthogonal Frequency
Division Multiplexing

employed 4G wireless
systems.

LTE-A

LTE — 4 G Cellular
Standard.

OFDM

Long Term Evolution

WiMAX — Worldwide
Interoperability For Microwave
Access.

LTE - A: LTE Advanced.
→ OFDM.

OFDM — Key wireless BROADBAND
Technology
Large Bandwidth.

General WiFi or WLAN

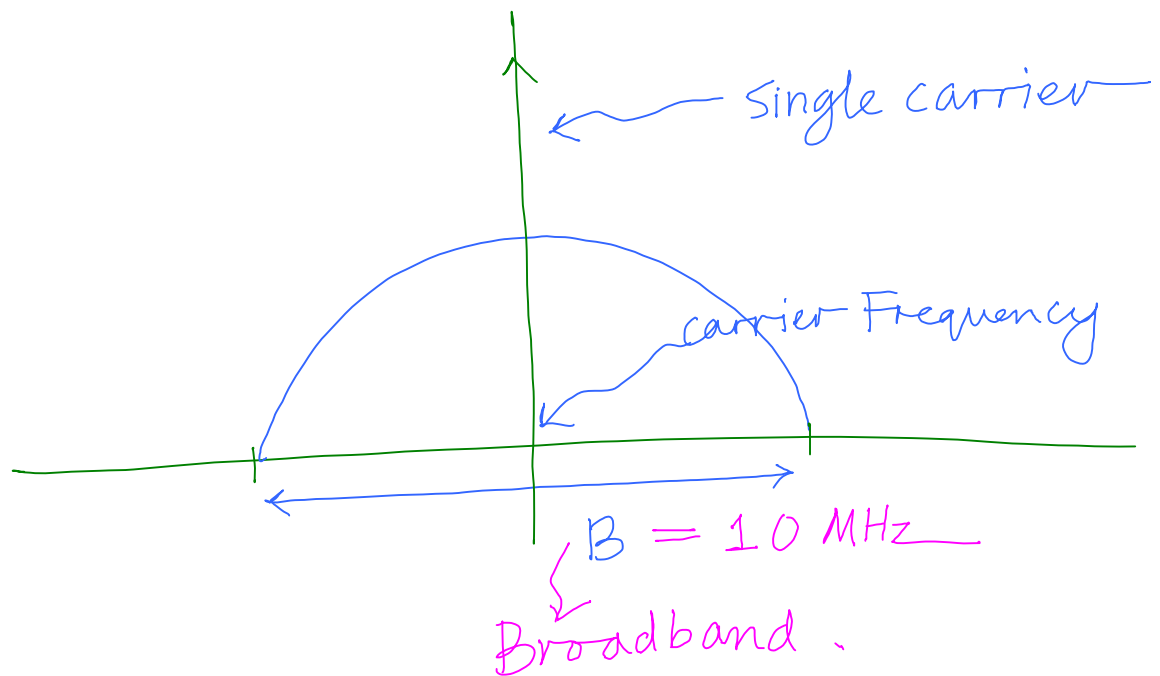
Wireless Local Area
Networks- Standards.

{ 802.11a, 802.11g, 802.11n,
802.11ac.

WLAN Standards.

OFDM.

Basic Principle of OFDM:



$$T = \frac{1}{B}$$

$$= \frac{1}{10 \text{ MHz}}$$

$$= \frac{1}{10 \times 10^6 \text{ Hz}}$$

$$= 0.1 \times 10^{-6} \text{ s}$$

$$= 0.1 \mu\text{s}.$$

Delay spread of channel

$$T_d \approx 2-3 \mu s.$$

Delay Spread.

$$T = 0.1 \mu s$$

$$T_d \approx 2 \mu s$$

$$\left\{ \begin{array}{l} T \ll T_d \end{array} \right.$$

Symbol Time $\ll$ Delay Spread.

→ ISI or Inter Symbol Interference.

As Bandwidth B increases.

Symbol Time $\frac{1}{B}$ decreases.

→ leads to ISI

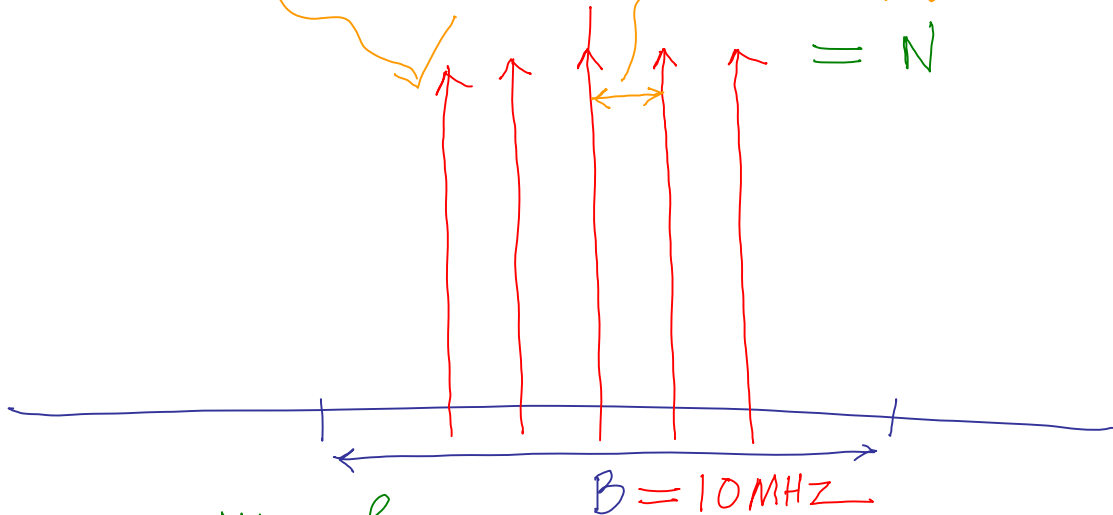
{ Significant challenge in a
broadband wireless system.
→ overcome ISI

Principle to overcome ISI

In each subband
place a sub-carrier

Smaller bands
= subbands.

= N



Bandwidth of
subband = B/N .

Example: $B = 10 \text{ MHz}$

$$N = 1000$$

$N = \text{number of subbands.}$

Bandwidth of each subband

$$= \frac{B}{N} = \frac{10 \text{ MHz}}{1000}$$

$$= \frac{10 \times 10^6}{10^3}$$

$$= 10 \times 10^3 = 10 \text{ KHz}$$

Symbol time in each subband

$$= \frac{1}{B/N} = \frac{N}{B}$$

$$T = \frac{1}{10\text{MHz}/1000} = \frac{1}{10\text{kHz}}$$

$$= \frac{1}{10 \times 10^3}$$

$$= 0.1\text{ms} = 100\mu\text{s}.$$

$$T = 100\mu\text{s}$$

$$T = 100 \mu s.$$

$$T_d = 2 \mu s$$

$$T \gg T_d.$$
$$100 \mu s \gg 2 \mu s$$

New symbol Time $\gg$ Delay Spread.

→ No ISI in new system
with multiple subbands and
subcarrier in each band.

Such a system with multiple subbands and multiple subcarriers is termed as a Multi Carrier Modulated (MCM) System.

MCM System.
→ Basis for OFDM.