

1-Mobility flexibility scalability  
cost effective enhanced collaboration  
increased efficiency remote access

2-enable communication between  
devices without the need for physical  
wired communication

core:

1-Access point 2-Antennas

3-wireless clients 4-Routers/switch

3-management & maintenance of computer  
systems & networks

tasks: configuring & troubleshooting  
wireless networks, managing user access  
ensuring security & monitoring system

4-because it provides mobility, flexibility  
& scalability

1 1

5- WPAN

WLAN

WMAN

WWAN

6- cellular: 1G: Analog voice → 2G digital voice → 3G Mobile internet → 4G (IP-based) Mobile broadband → 5G Massive data, IoT wifi; evolved from 802.11 (2Mbps) to wifi 7 (802.11be, 46 Gbps)

7- 802.11 b/g/n; operate in the 2.4 GHz increased speeds - 11, 64, 600 Mbps

802.11 a/m/ac/ax: 5GHz

highest speeds & features like MIMO

802.11ax (Wi-Fi 6) : 2.4 & 5 GHz

higher efficiency & lower latency

802.11be (Wi-Fi 7) : 2.4, 5.2, 6 GHz offering the fastest speeds & lowest

8-ITU

ECC  
ETSI

National regulators

9- Frequency: measured in Hz  
Amplitude: The strength or power of a wave  
Phase: the offset of wave from point

10- Constructive interference - when crest of one waves aligns with the crest of another, ~~weakening or canceling~~ reinforcing the signal. This is beneficial for wireless communication.

Destructive interference - occurs when the crest of one wave aligns with the trough of another weakening or canceling the signal.

11-  
21- is specific type of frequency  
within the range of 3 Hz to 300 Hz  
It's forms cornerstone of wireless.

12-

Licensed spectrum      Unlicensed spectrum

government authorization open for public use

Less interference

more interference

operators must be free to use  
pay

Higher reliability

Lower reliability

13- data modulation

signal transmission

data reception

conversion

11

14- App; indoor high speed Internet  
environments sensitive to RF

advant; High bandwidth, increased  
security

15-

VLC; uses visible light for data  
transmission

Li-Fi - high-speed implementation

16- is the process of varying a carrier  
signal with an information  
technique

Analog; AM, FM, PM

Digital; ASK, fSK, PSK, QAM

17- signal over a wider frequency band  
than necessary to improve security

DSSS; data signal multiplied by a  
p pseudo-random code to spread it

FHSS; carrier frequency rapidly  
hops between many channels  
in pseudo-random sequence

الخطارة  
الصورة

18 - that converts electrical signals into electromagnetic waves  
 & vice versa

$E_d$ ,  $P_d$ ,  $\delta B$  - Radiation, bandwidth  
 type, dipole, monopole, patch, yagi-uda

19 - How electromagnetic waves travel from transmitter to receiver  
 modes, ground wave, sky wave  
 effects, reflection, diffraction,  
 scattering, attenuation

20 -

Line of sight

clear

stronger

direct path

Non Line of sight

obstructed path

weaker, prone to  
 attenuation

via reflection

## 21-Signal power

Fading; variation in signal  
Multipath interference; multiple signal copies arrive at different time  
Noises; unwanted signals  
Interference; overlapping signals from other ~~free~~ devices  
Fopples shift; change in signal frequency due to relative

## 22-error detection

Automatic repeat-request  
spread spectrum  
diversity techniques