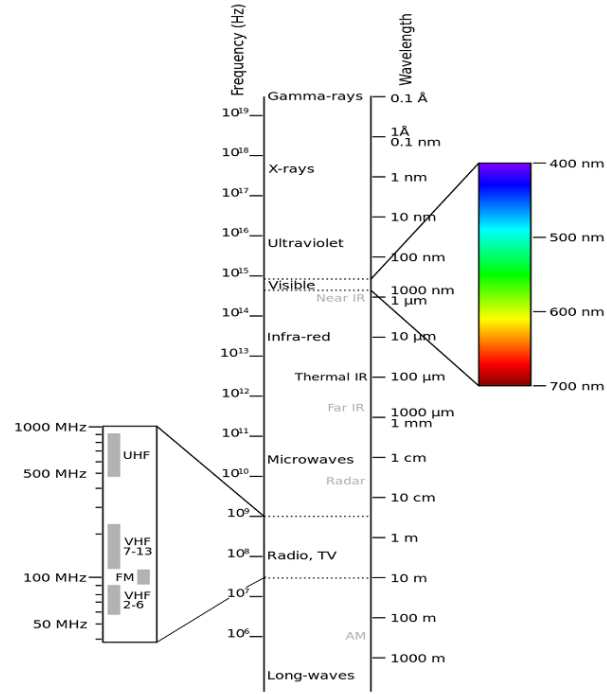


**FREQUENCY RANGE AND TYPE OF WIRELESS  
COMMUNICATIONS**

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## ELECTRO MAGNETIC WAVES SPECTRUM



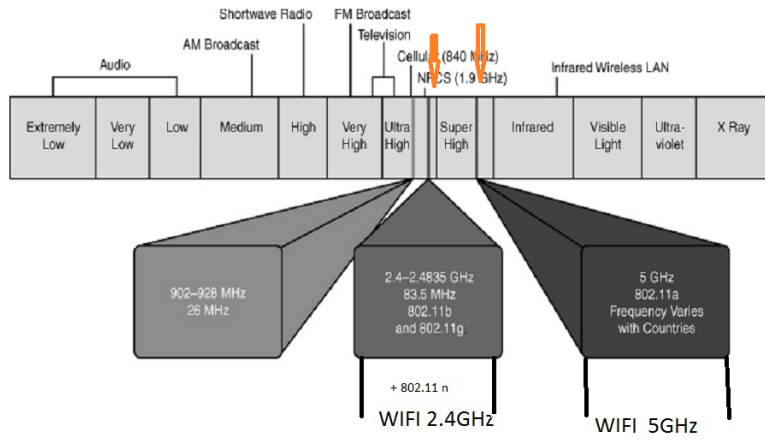


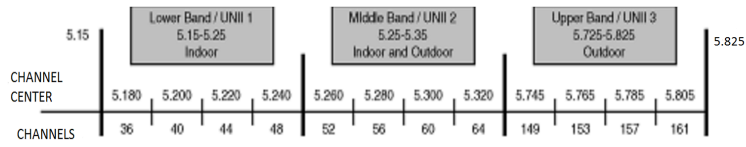
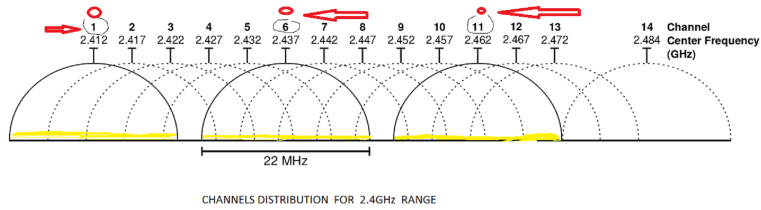
CHART SHOWING LOCATION OF 802.11 FAMILY SPECTRUM



TYPICAL WIRELESS NETWORK

802.11 network PHY standards									
802.11 protocol	Release date	Freq- uency (GHz)	Band- width (MHz)	data rate		Allowable MIMO streams	Modulation	Approximate range	
				(Mbit/s)				Indoor (m)	Outdoor (m)
—	Jun 1997	2.4	22	1, 2		N/A	DSSS, FHSS	20	100
a	Sep 1999	5	20	6, 9, 12, 18, 24, 36, 48, 54		N/A	OFDM	35	120
b	Sep 1999	2.4	22	1, 2, 5.5, 11		N/A	DSSS	35	140
g	Jun 2003	2.4	20	6, 9, 12, 18, 24, 36, 48, 54		N/A	OFDM, DSSS	38	140
n	Oct 2009	2.4/5	20	7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2		4	OFDM	70	250
			40	15, 30, 45, 60, 90, 120, 135, 150				70	250
ac	Dec 2013	5	20	7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2, 86.7, 96.3		8	OFDM	35	
			40	15, 30, 45, 60, 90, 120, 135, 150, 180, 200				35	
			80	32.5, 65, 97.5, 130, 195, 260, 292.5, 325, 390, 433.3				35	
			160	65, 130, 195, 260, 390, 520, 585, 650, 780, 866.7				35	

IEEE 802.11 family



SHANNONS THEOREM

$$\text{Capacity} = M \cdot B \cdot \log_2 \left( 1 + \frac{S}{N} \right)$$

Multiple channels

Bandwidth

Spectral efficiency  
(Shannon's capacity theorem)

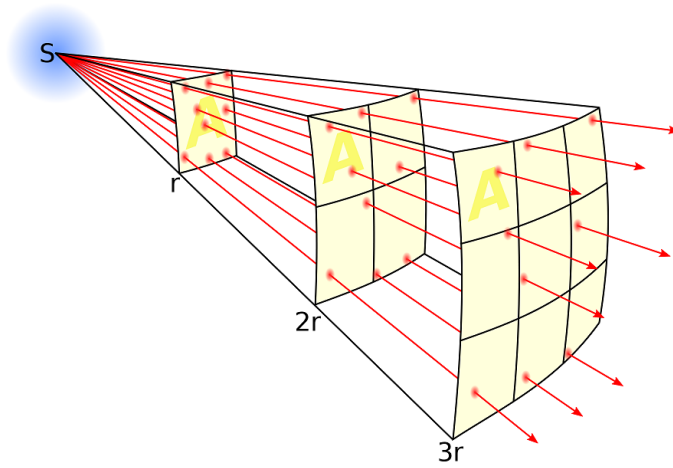
PATH LOSS FORMULA

$$L = 20 \log_{10} \left( \frac{4\pi d}{\lambda} \right)$$

some constant

transmitter - receiver dist

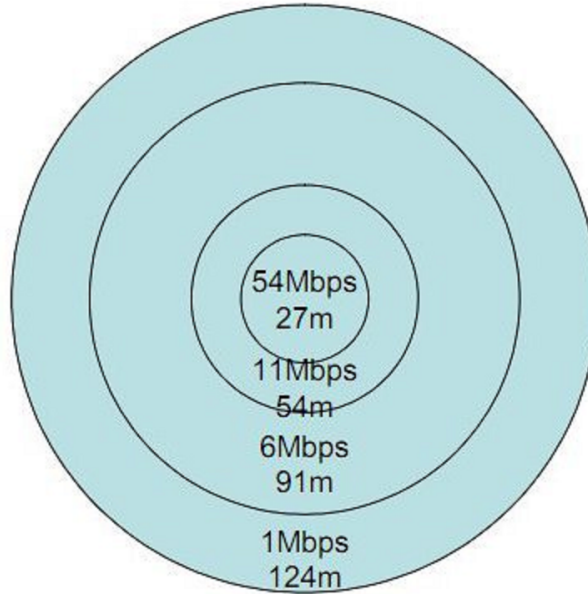
wave length



HOW POWER OF TRANSMITTED SIGNAL DECREASES  
ALONG THE WAY TO RECEIVER



HERE IS SHOWN HOW WAVES FADE AWAY WITH DISTANCE



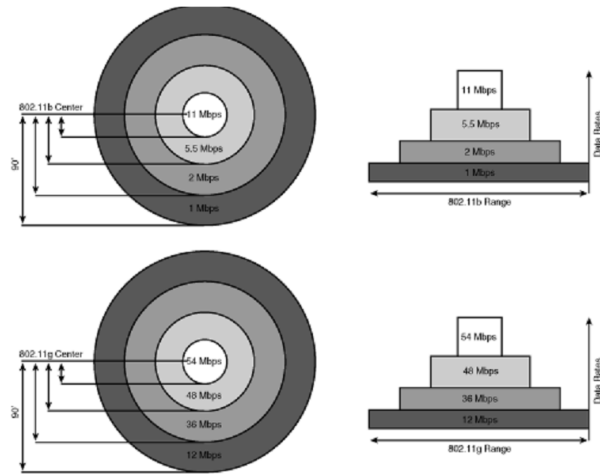
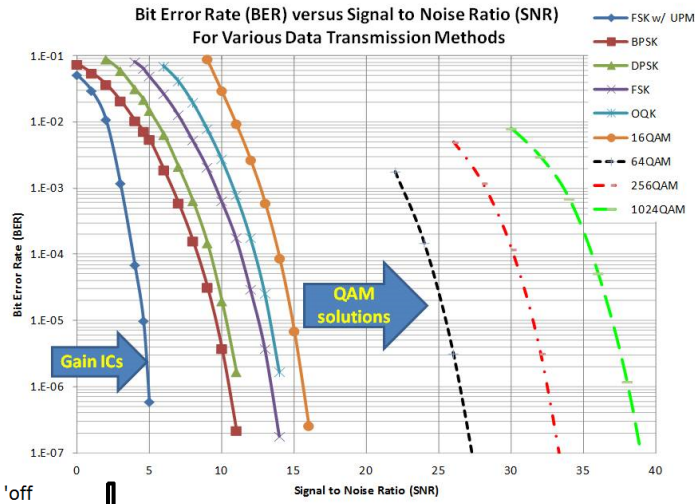


CHART SHOWING RATE vs RANGE FOR .11b AND .11g

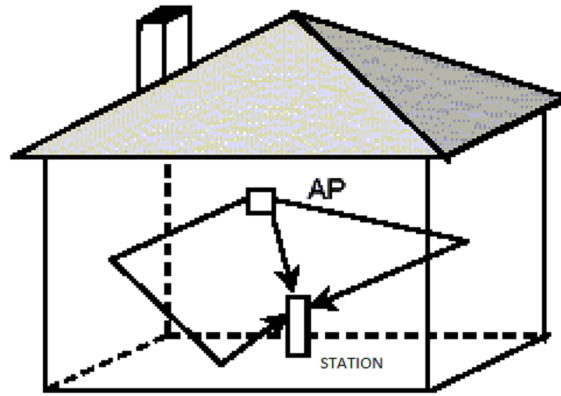
Note that to different rates corresponds as a rule different coding/modulation types



'off charts'  
BER

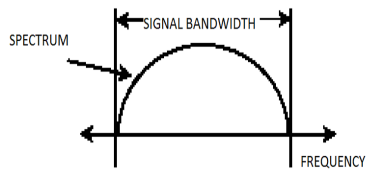


CHART BER vs SNR

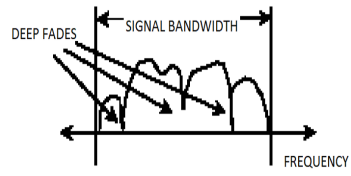


POSSIBLE SIGNAL PATH FROM AP TO USER

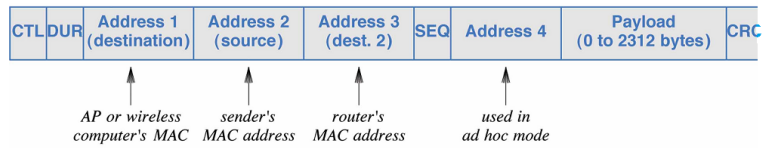
WHAT COULD HAPPEN TO SIGNAL ALONG THE WAY TO RECEIVER



TRANSMITTED SIGNAL SPECTRUM



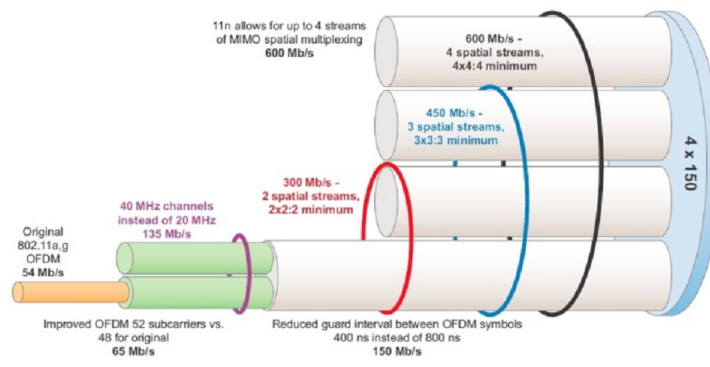
DISTORTED RECEIVED SIGNAL SPECTRUM



The frame format used with an 802.11 wireless LAN.

payload is typically fewer  
than 1500 bytes

BONDING CHANNELS



Advertisible throughput is obtained by " sending and receiving " pure payload without any overhead

Throughput varies based on a number of different factors. We can roughly approximate Wi - Fi throughput to be about half advertised throughput in the best case : LOS close to transmitter, no interferences and multipath ways.