

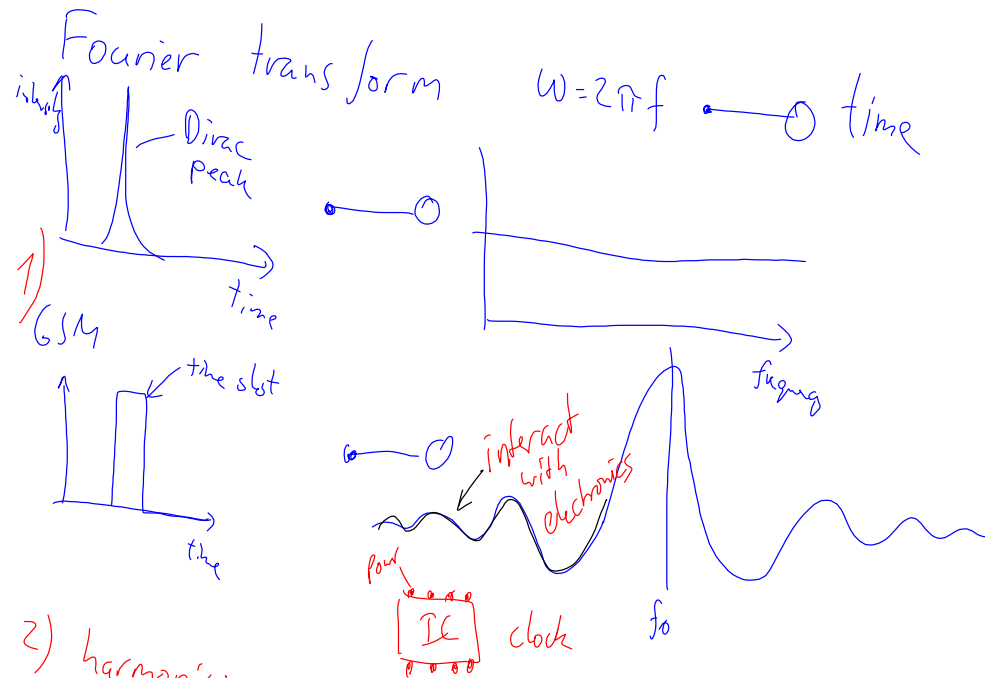
GSM
 < 80ms
 modulation
 coding
 Analog → digital
 sample

9083806 SMS → Signalling → Your operator
 Voice — locally set-up
 T-Mobile, Orange

Interferenz

88.8 MHz radio FM

GSM/UMTS band Messaging/Signalling 1800 MHz
 1 GSM slot 200 kHz



2) harmonics

$$n f_1 \pm m f_2 = f_{res} \quad / \quad f_1 - f_2 = 20 \text{ MHz}$$

5G → ^{Future} 6G, 7G

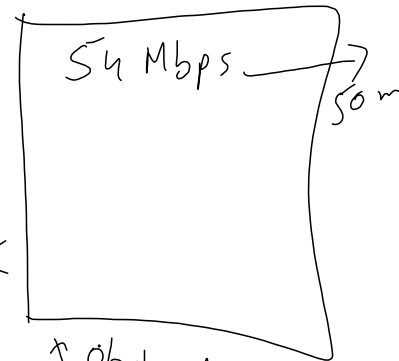
* THz

Non-ionization wifi

* T Rays

* No damage to electronic

* Less signal loss



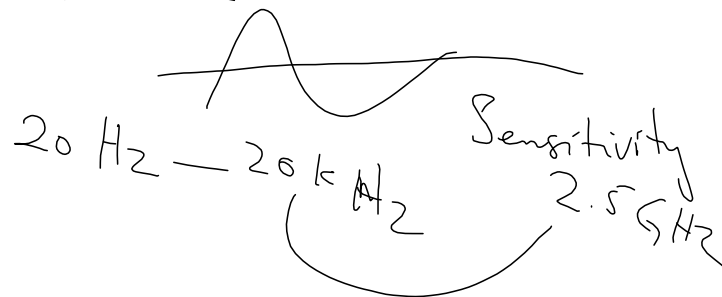
- * obstacles
- * Interfer
- * Data load
- * Data lag
- * Signal strength

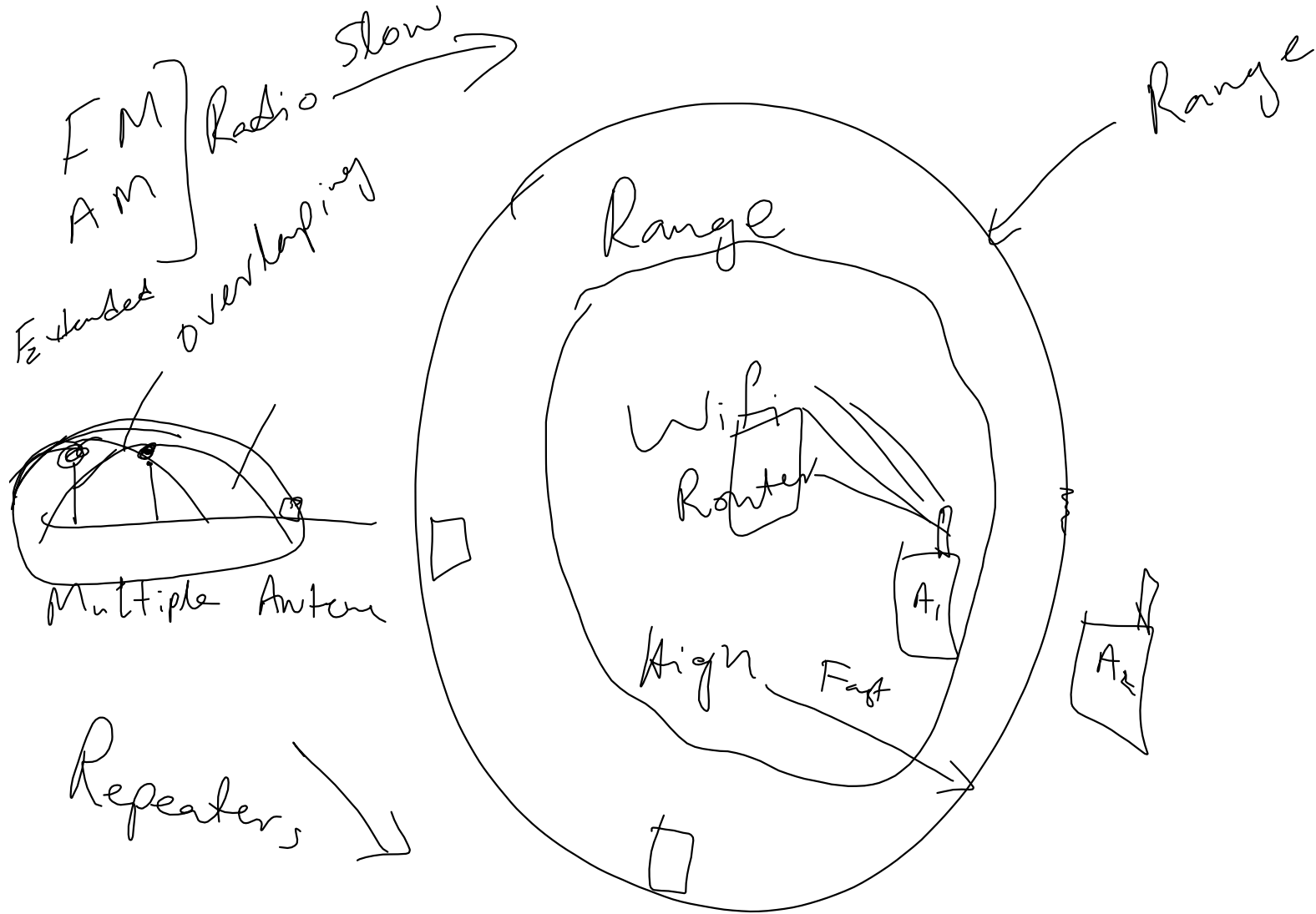
Params

Range

10³ → 20log
↓ db

10 → 10
Wireless db — Analog



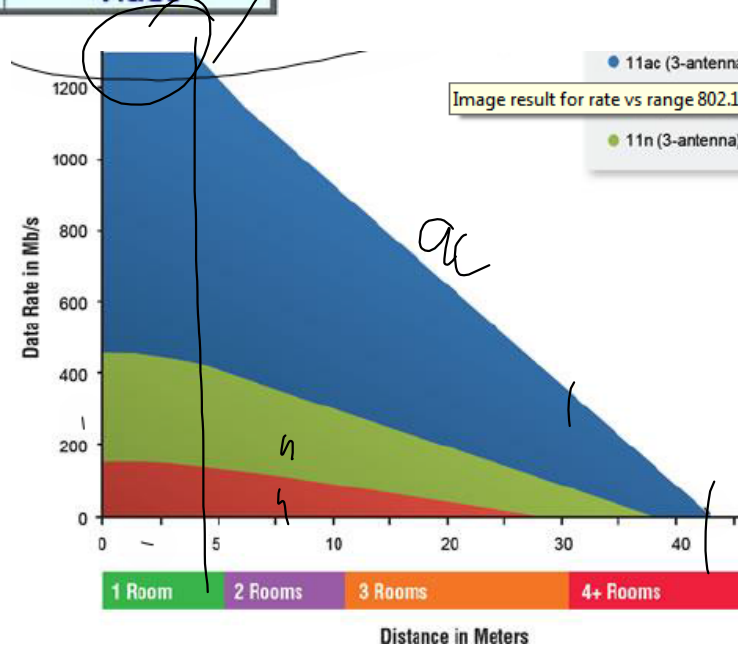


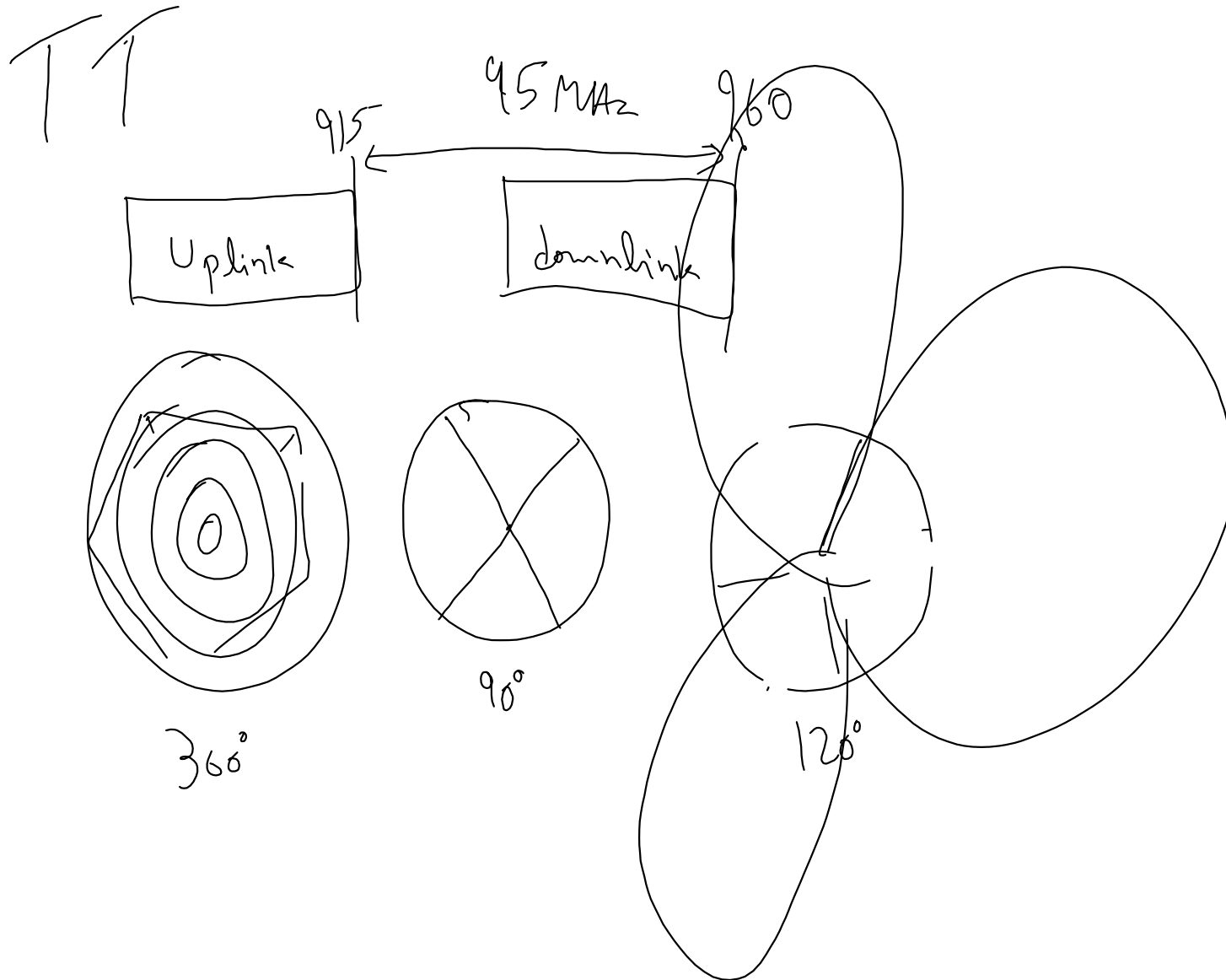
	802.11n	802.11ac	802.11ad
Throughput	600 Mbps	3.2 Gbps	Up to 7 Gbps
Coverage	Home, 70 m	Home, 30 m	Room, <5m
Freq. Band	2.4/5 GHz	5 GHz	2.4/5/60 GHz
Antennas	4 x 4 MIMO	8 x 8 MIMO	>10 x 10 MIMO
Applications	Data, Video	Video	Uncompressed Video

300 Mbps / 30m

1 300 Mbps / 4m

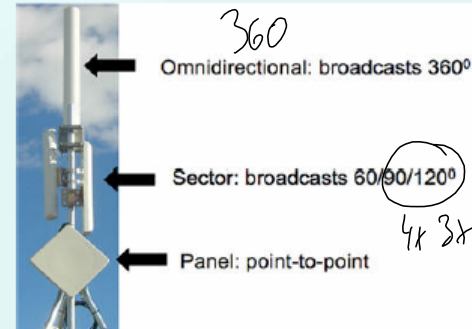
Manu
Marketing





System Capacity

- ▶ Sectoring
 - ▶ Use directional antennas
 - ▶ Omni
 - ▶ Sector
 - ▶ Panel
- ▶ Frequency reuse of channels
- ▶ Cell splitting increases the number of BS deployed which allows orderly growth of the cellular system
- ▶ Limit the coverage area of each BS to small geographical area called cell.

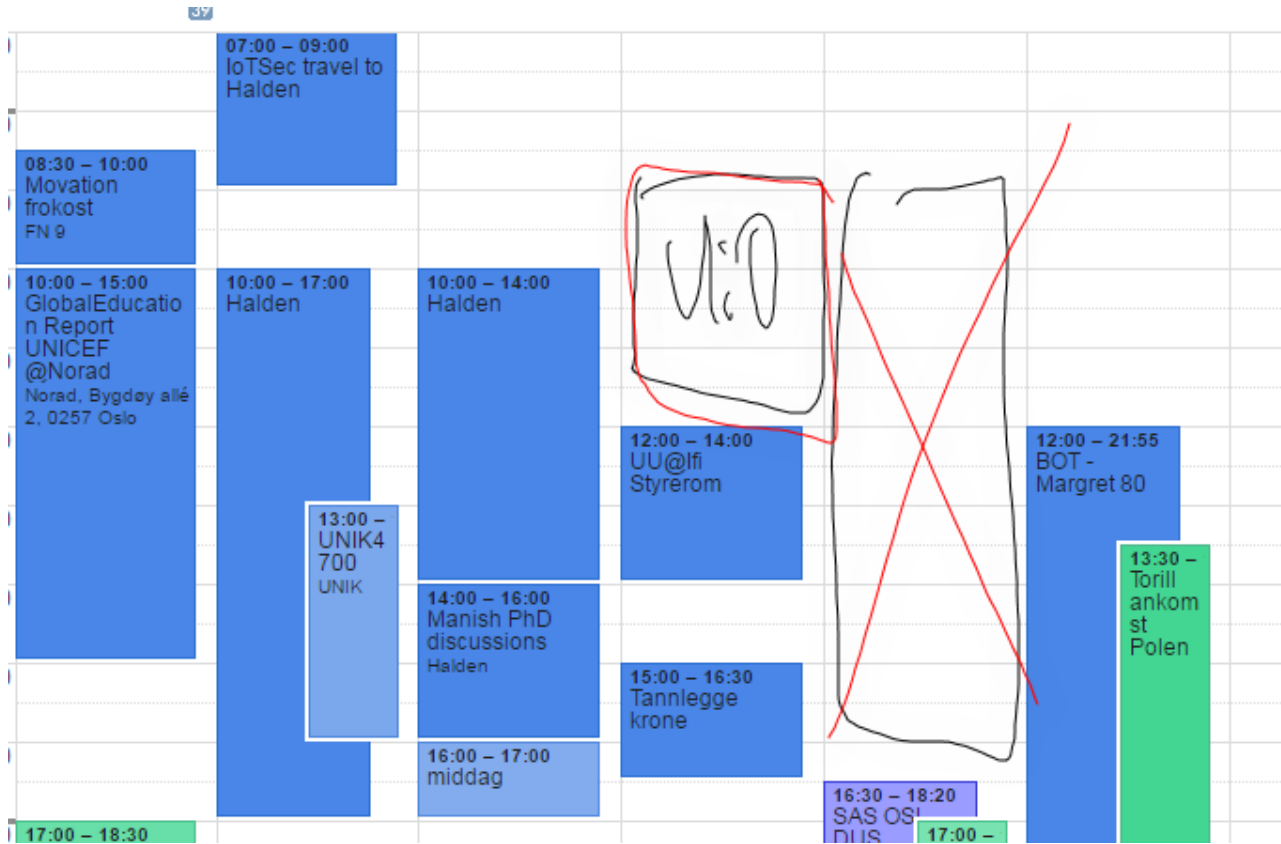


3 or 4 sectors :
 120° 90°

- range/coverage - price
 - Capacity # users - frequency reuse interference
 - handover

Omni → 3 300% - x
 4 400% - x
 ~~4/3 ≈ 1.33~~

Next lecture 29.9. 0900 - 1200 @U:O
18.10. 1300 - 1600 @ UNIK



IMSI catcher NTNU

software defined base station FFI

s://www.google.no/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=imsi%20catcher%20ntnu

[www.antenposten.no/.../New-report-clear-signs-of-mobile-surveillance-in-Oslo-despr...](#)

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Van Thanh Do - NTNU

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