brain store ? 1 Mbit/s

32 kbit/s

audio 64 - 1284 kbit/s

7 stereo

old analog 512 kbps

digital 2 Mbit/s

4k ~ 10 Mbps (?)

4k

Power vs dB

dBm

$P_{dBm} = 30 + P_W$

$P_{dB} = 10 \log P_{watt}$

dBm mW

10^3 mW

3 dB ~ 2x

E3

1/2

$P_T = 25\,W$

$P_{dBm} = 10 \log(2{,}5\ E.4)$

$40 + 10\log(2.5)$

$40 + 4 = 44$

dBm

Loss $P_R = P_T + G_T + G_R + 20 \log \frac{\lambda}{4\pi R}$

$\lambda = \frac{c}{f}$ $\frac{3E8\ m/s}{f\ (GHz)} = \frac{3E10\ cm/s}{f \cdot 1E9\ 1/s}$ $-20 \log \frac{4\pi R \cdot f}{c}$

$\lambda = \frac{30\ cm}{f\ [GHz]}$

$f =$	5 GHz	10	20 GHz
$\lambda =$	6 cm	3	1,5 cm

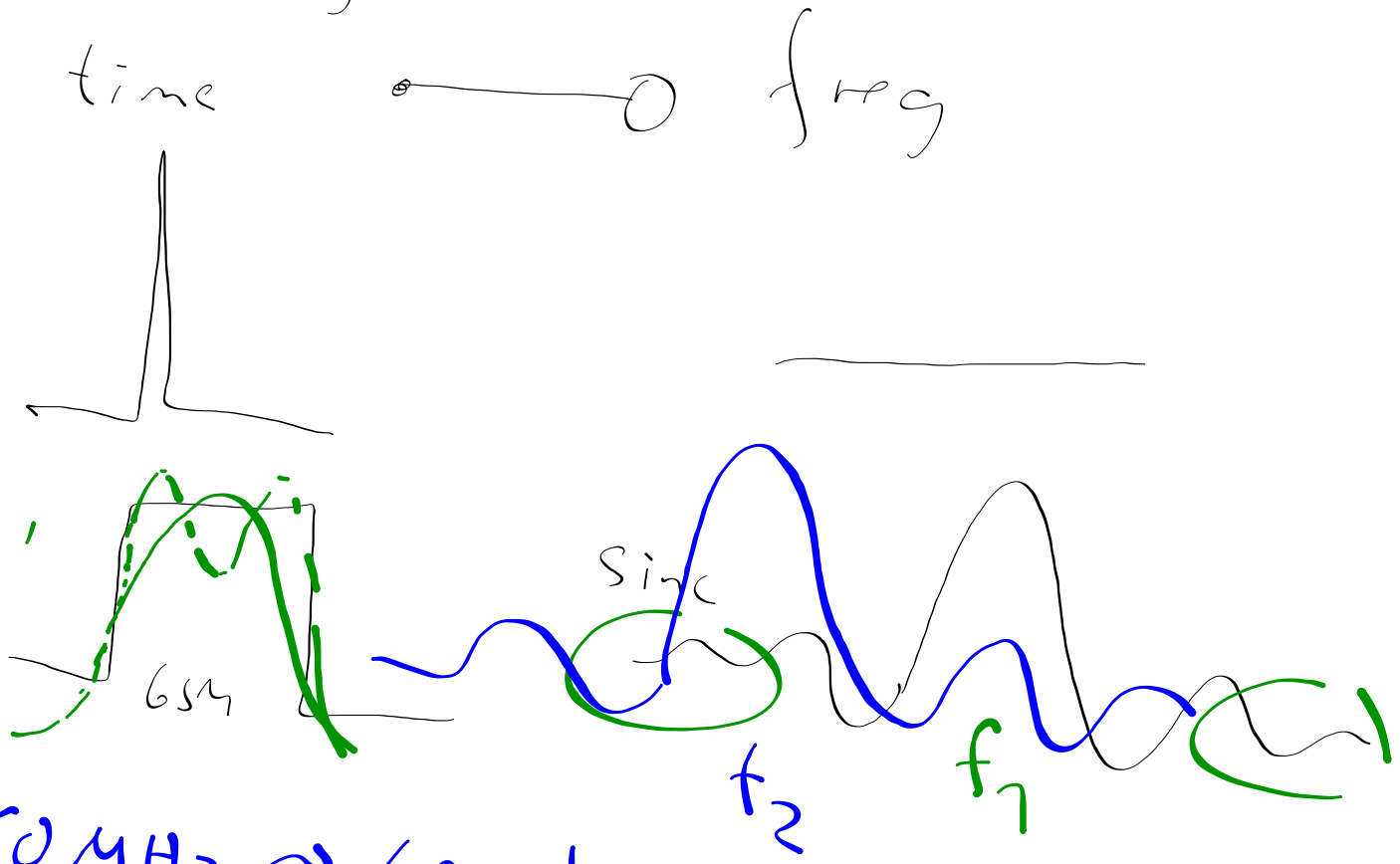
Shannon $C = W \log_2\left(1 + \frac{S}{N}\right)$

2.4 GHz 85 MHz ~10% f_c 1 GHz ~ 100 MHz BW

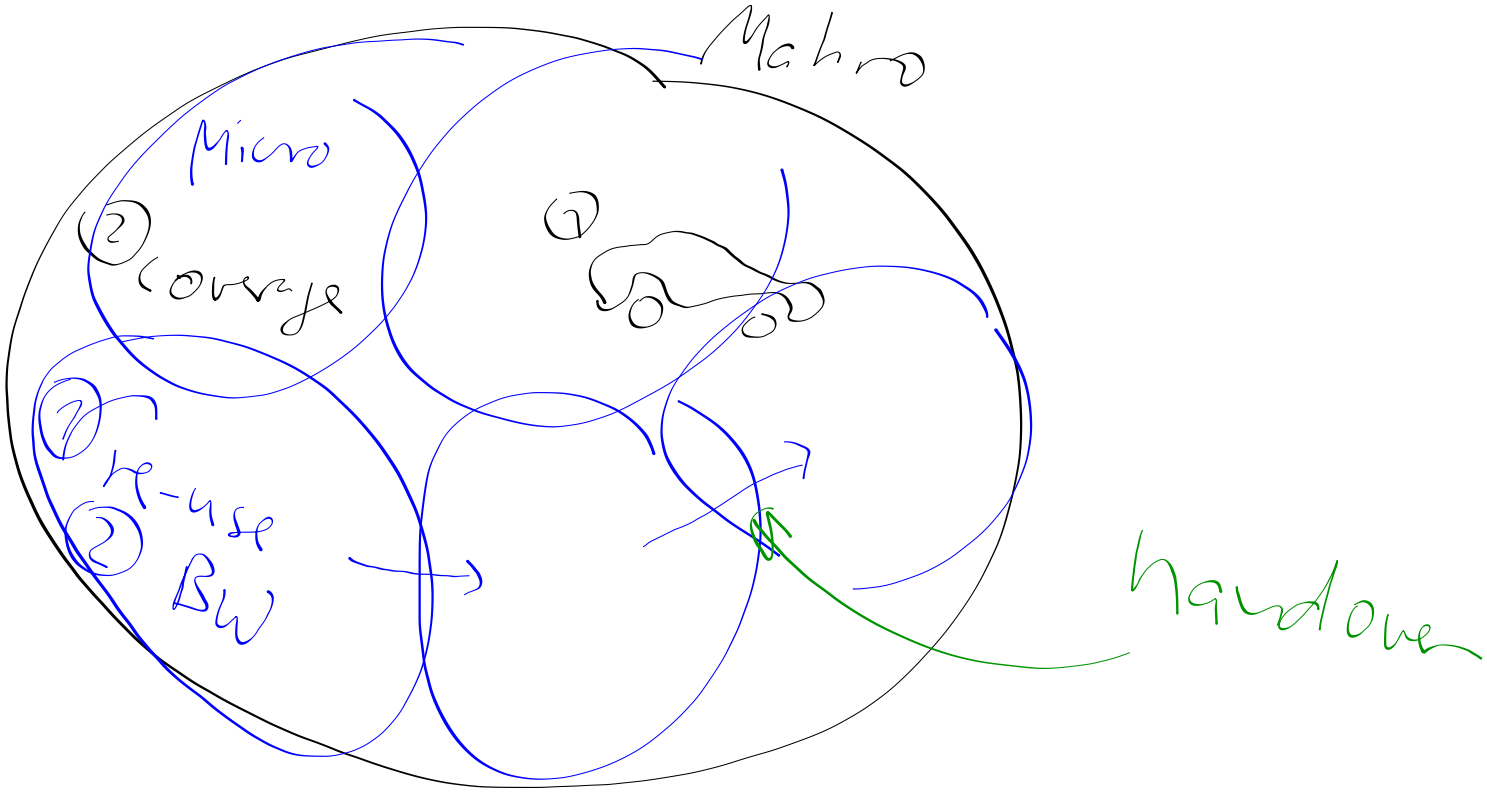
5 ... 5.8 GHz **200–400 MHz**

Fourier transform

time ⟷ freq



3G 60 MHz → 6 parts


Macro
Micro
coverage
re-use
BW
handover