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ESMO RADAR PROPOSAL

including extensions after kick-off meeting in Guildford Oct 5-8th, 2009

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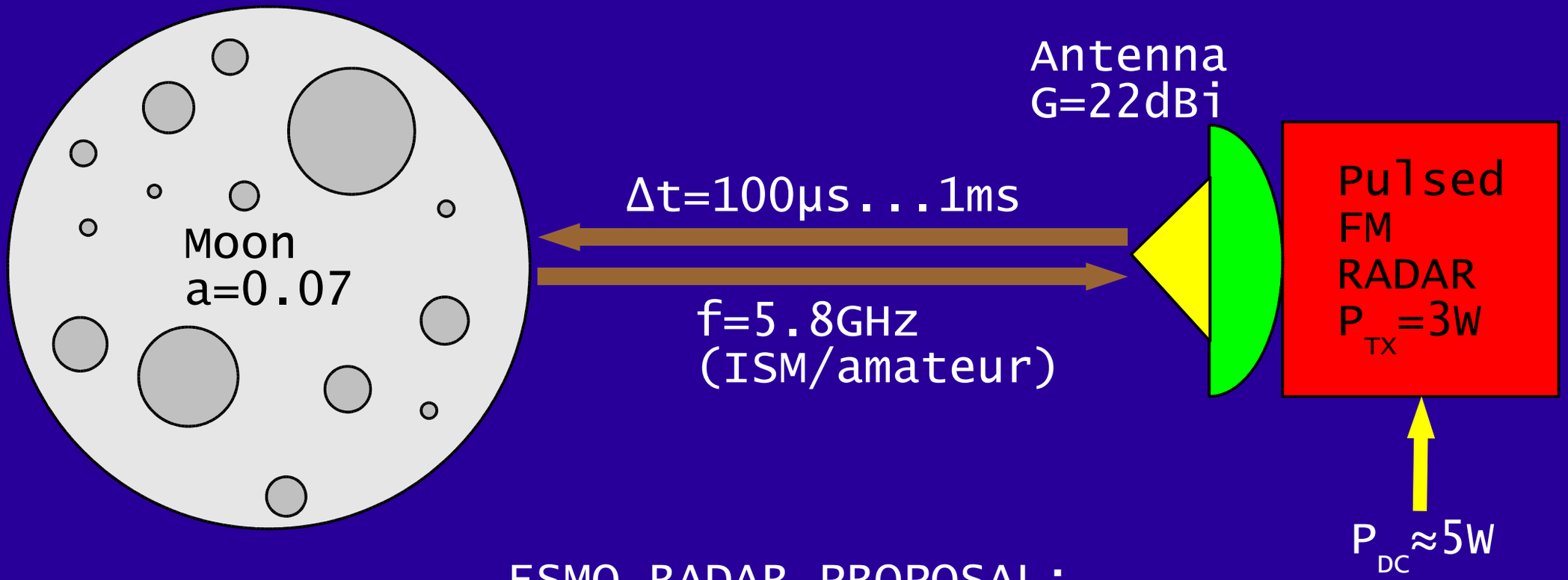
http://www.s5tech.net/s53mv/



ESMO RADAR PROPOSAL:

Pulsed-FM RADAR: f=5.8GHz (λ=5.2cm), P_{TX}=3W (+35dBm)

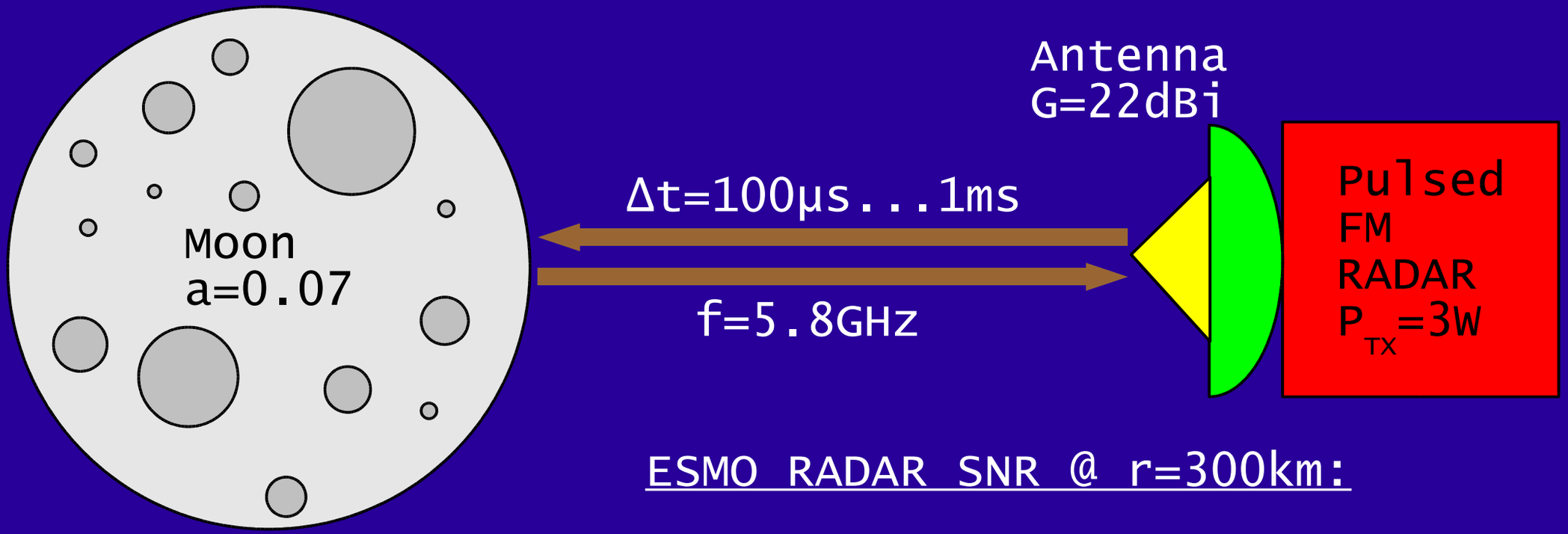
Antenna: G=22dBi (158), diameter d=25cm

Useful range up to r=300km, total experiment mass m≈1kg

Radio altimeter (100bit/s) & 1D RADAR (10kbit/s)

No synthetic aperture & no imaging (2D nor 3D) due to:

small antenna, low power, limited processing & data rate



ESMO RADAR SNR @ r=300km:

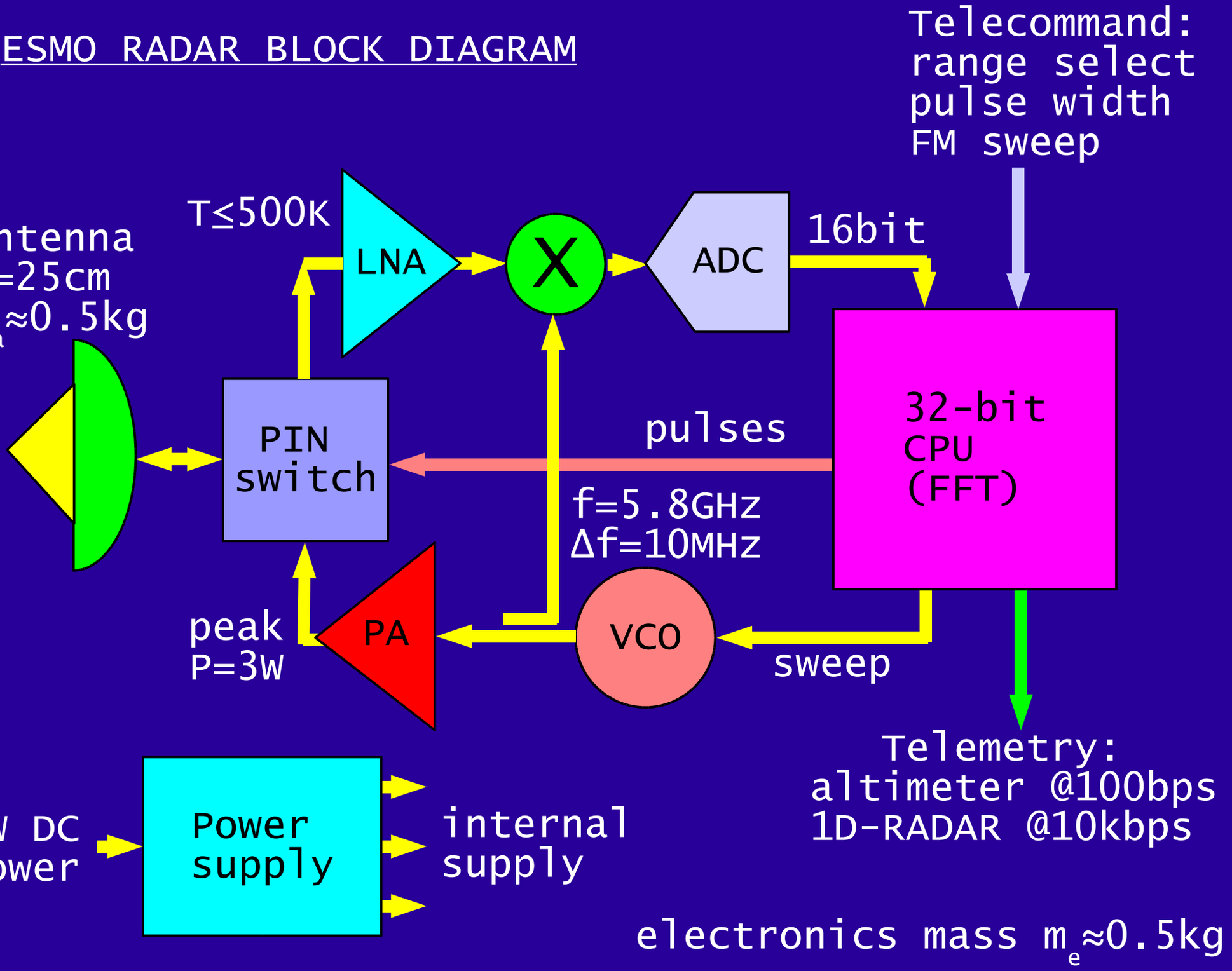
$$P_{RX} = P_{TX} \cdot G^2 \cdot \left(\frac{\lambda}{8 \cdot \pi \cdot r}\right)^2 \cdot a = 0.25\ pW\ (-96\ dBm)$$

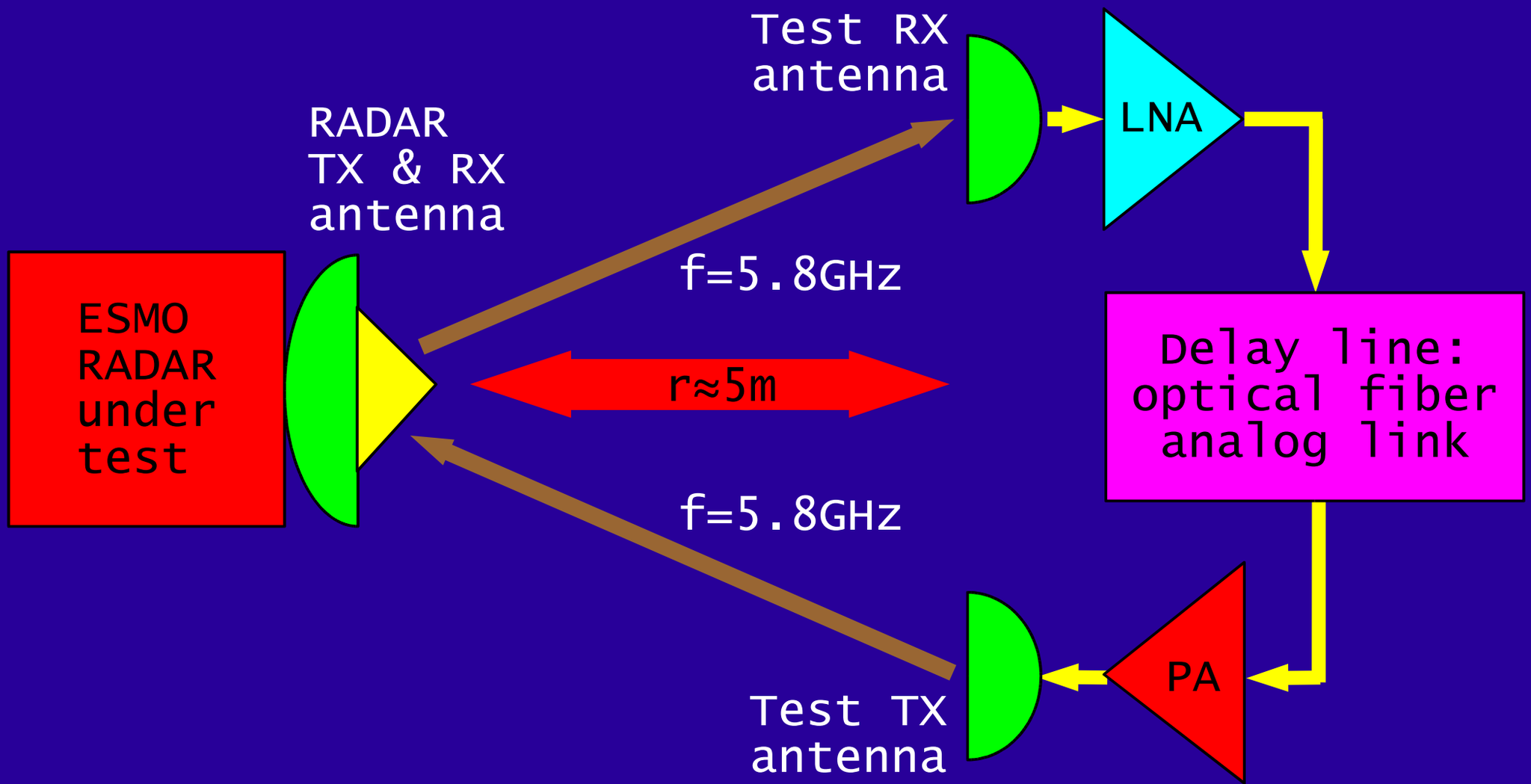
B≈10kHz, k_B=1.38E-23J/K, T≈1000K

$$P_N = B \cdot k_B \cdot T = 1.38 \cdot 10^{-16}\ W\ (-128.6\ dBm)$$

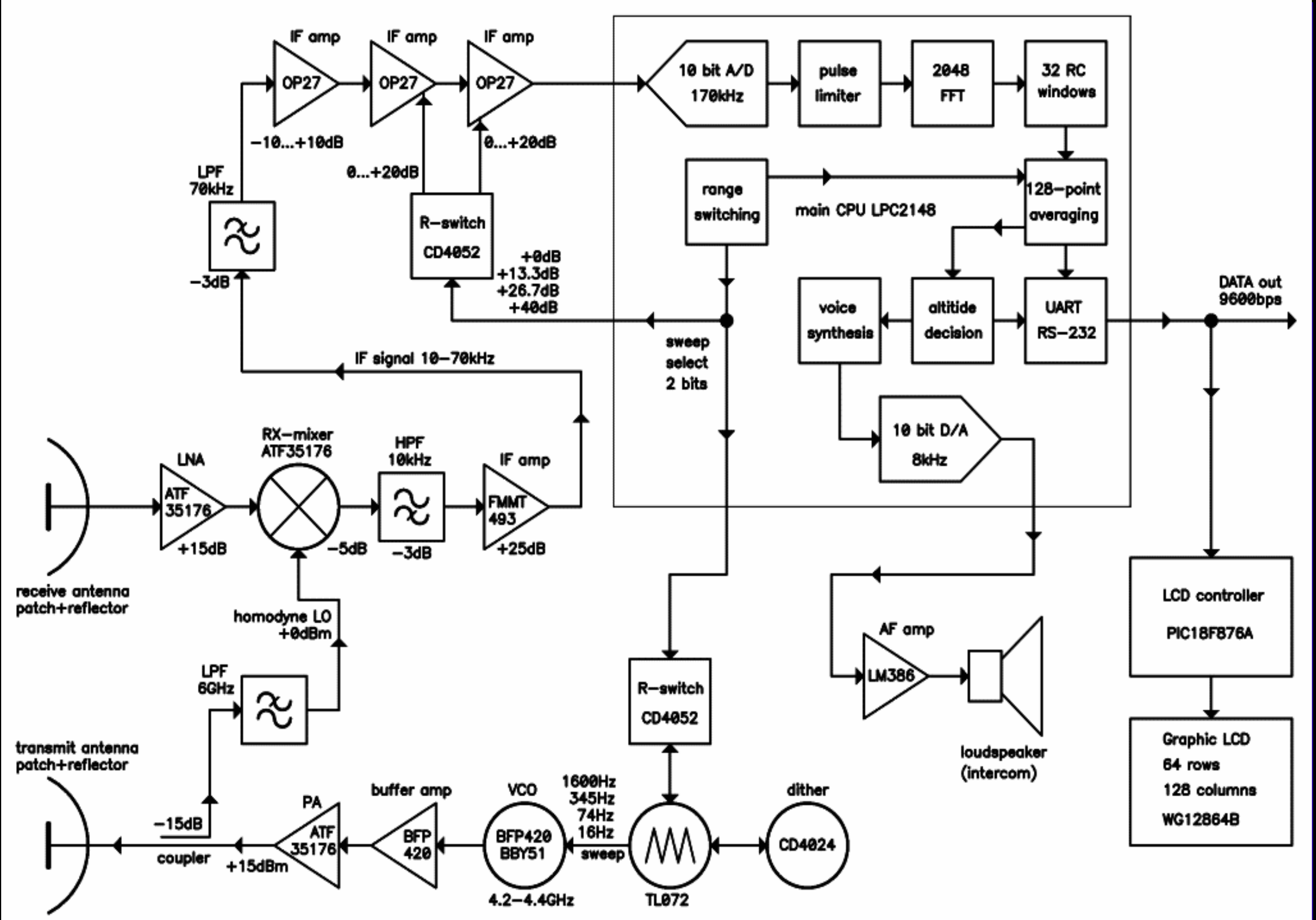
$$SNR = P_{RX} / P_N = 1800 = 32.6\ dB$$

ESMO RADAR BLOCK DIAGRAM

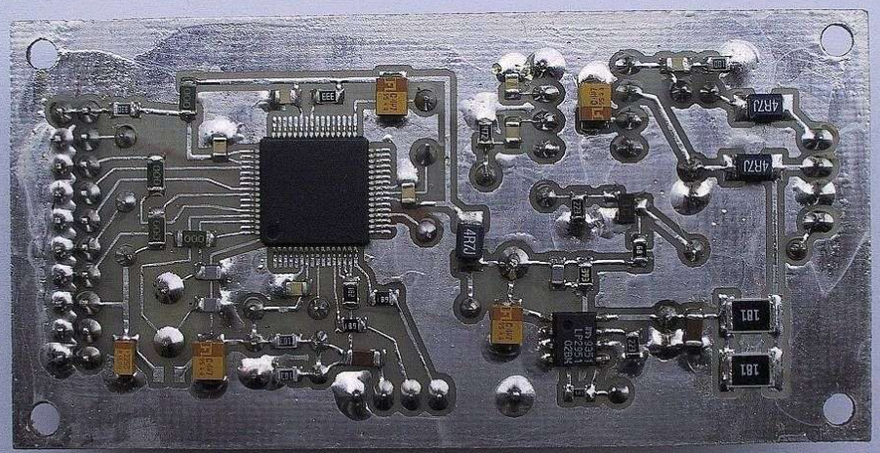


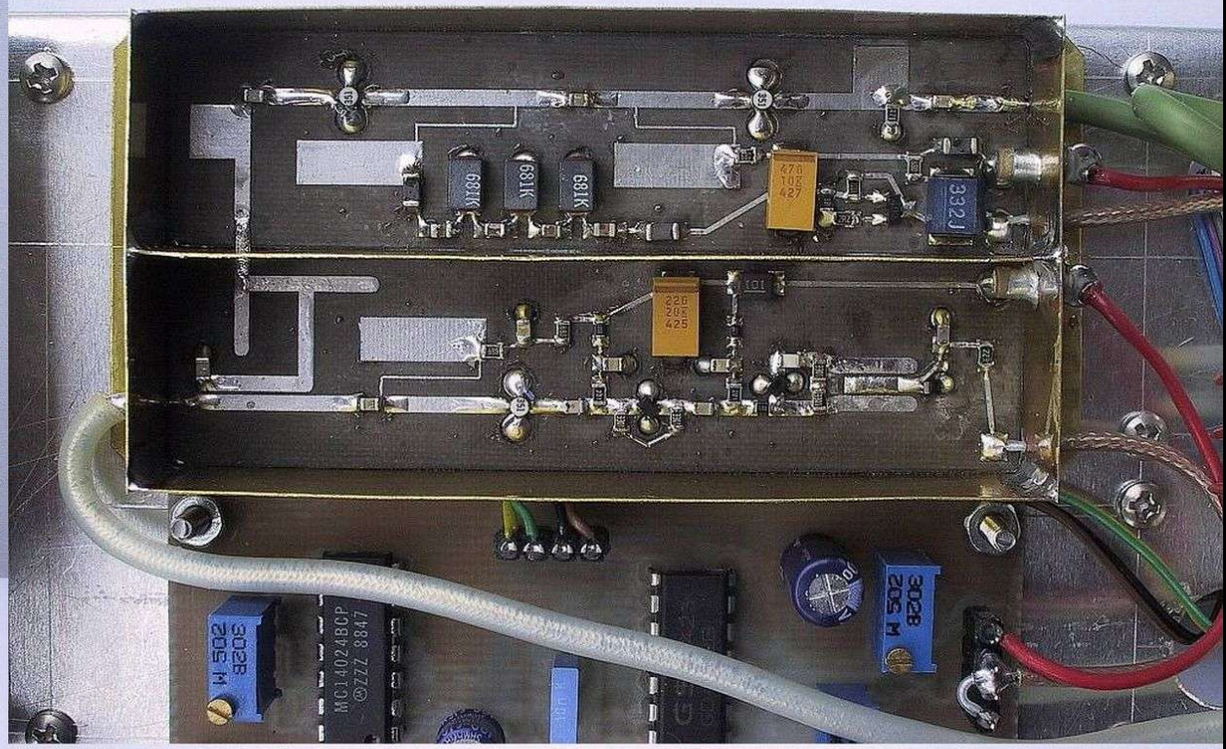


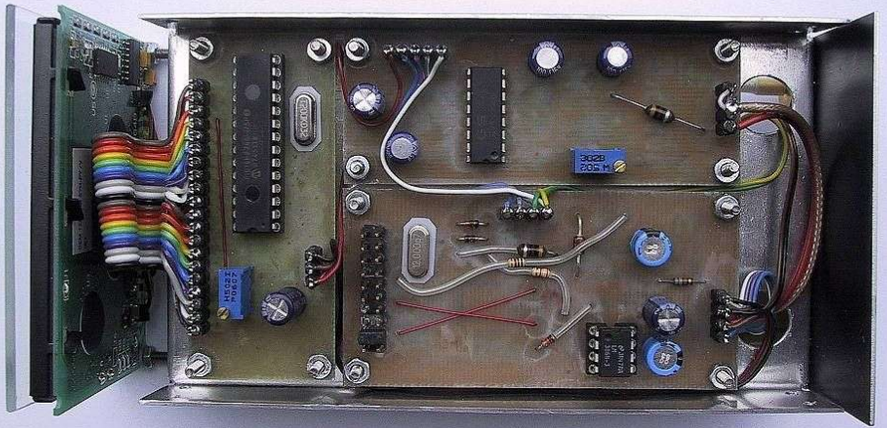
ESMO RADAR GROUND TESTING

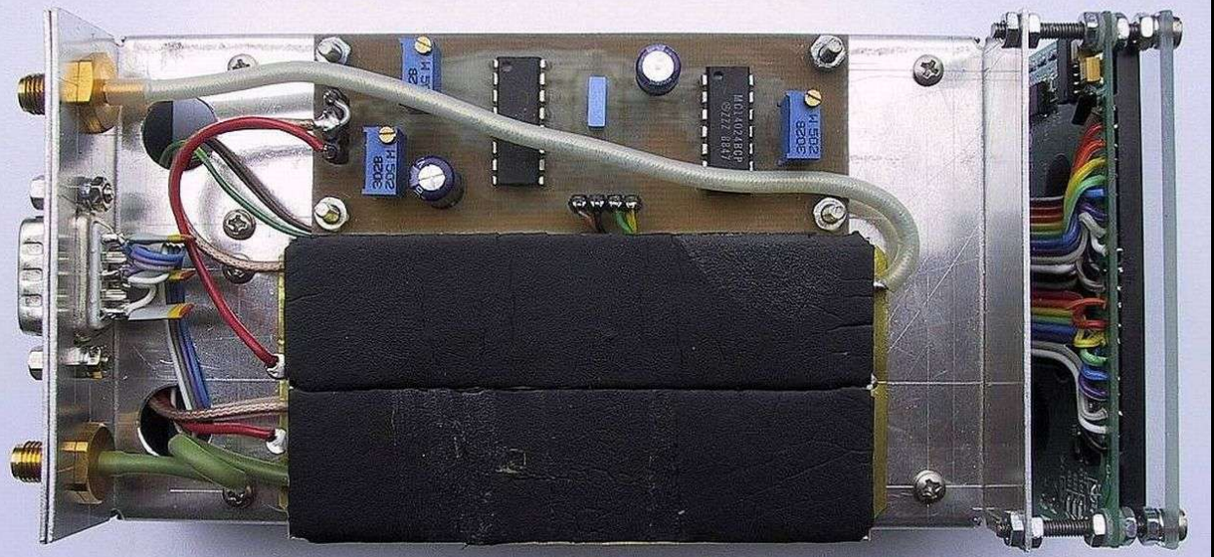


Airborne RADAR: 4.3GHz, 30mW, 1.5km range, dual antenna



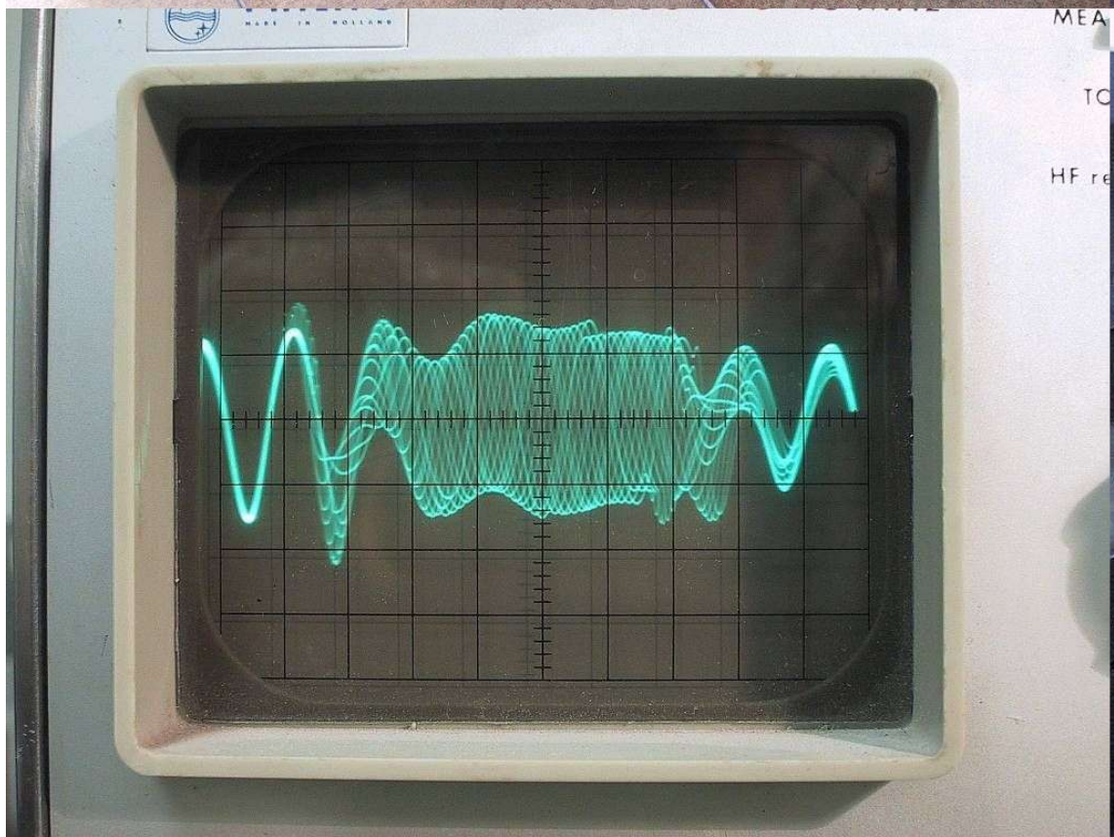






Electronics mass m=0.33kg

Airborne RADAR hardware: digital & microwave (4.3GHz)




19.17
BRAUNIGER
S5-PCV
ALPHAMFD


3000
1000
300
100
30
500
19.

PROPOSED ESMO RADAR EXTENSIONS

(after kick-off meeting in Guildford Oct 5-8th, 2009)

1) Microwave passive radiometer @ 5.8GHz to complement the data from other ESMO radiometers (3GHz & 10GHz). The proposed radiometer simply operates the RADAR hardware as a microwave receiver. No additional hardware is required. The expected power consumption is 1W in this mode.

2) High-speed (~10Mbps) BPSK downlink using the RADAR transmitter and a dedicated data input from the onboard mass-storage device. Very simple additional hardware is required inside the RADAR: an additional mixer. This ~10Mbps downlink is intended to be used at apoapsis, where most instruments provide no meaningful data and the ESMO spacecraft can be reoriented using momentum wheels to point the high-gain RADAR antenna towards the Earth. The expected power consumption is 10W in this mode. Intended use: NAC images & raw SAR data playback.

3) SAR 2D-RADAR at very low periapsis (below 50km) requires a dedicated ~10Mbps data output to the onboard mass-storage device. The expected power consumption is the same as the altimeter/1D-RADAR around 5W average.

ESMO RADAR EXTENSIONS