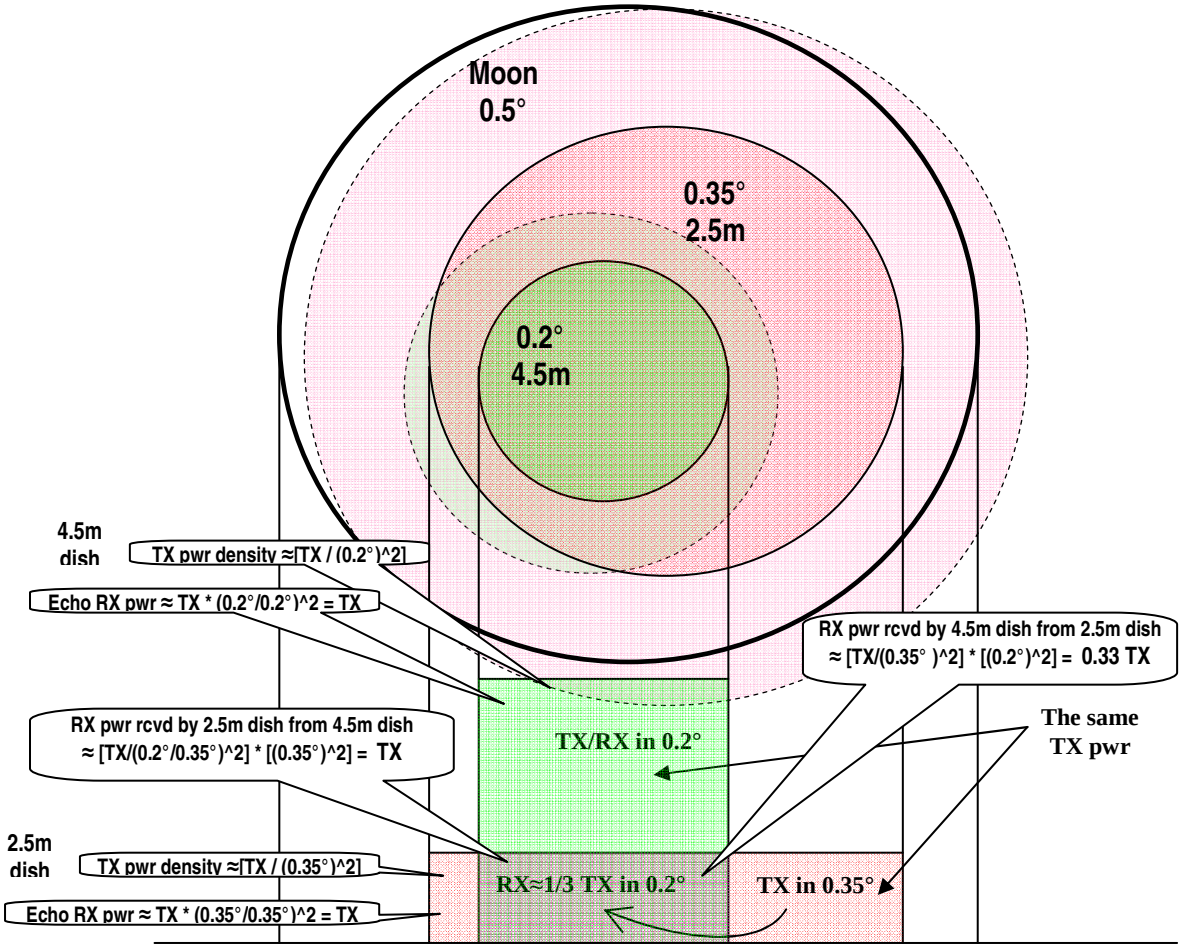
Constrains of EME on 24 GHz – pointing & beam-widths

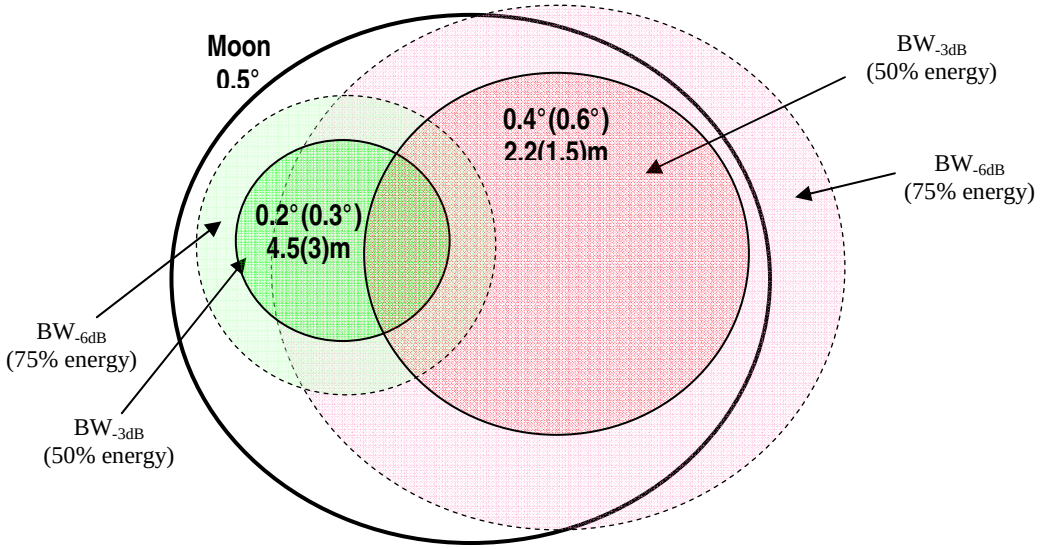
Big dish (e.g. 4.5m) vs small dish (e.g. 2.5m) when both beams coincide

(*The pictures below are simplified for ideal conical beams at -3dB & -6dB level; real world beams will be more smooth, approx. 1.5*BW$_{-3dB}$ for approx. 70…75% of total energy in the beam)*



The best case: Bigger dish(4.5m) receives 1/3 of TX power transmitted by smaller dish(2.2m) In opposite way, the smaller dish receives the full transmitted power[1] from bigger dish !

Reality can be even worse when narrower beam does not coincide with the wider beam:



[1] Incident power density in small [(0.2°)^2] area from bigger 4.5m dish falls inside [(0.35°)^2] area. This spot density relates to [(0.2°/0.35°)^2]-times lower power density in the whole [(0.35°)^2] area. This power density is equal to the incident power density from the smaller 2.5m dish with the same TX power. In summary, 2.5m dish receives from bigger 4.5m dish similar power as its own echoes with the same TX power and s/n ratio is similar as for own echo.