Namaste Downlink G/T and RF Level Analysis

"Downlink design must meet G/T requirements and deliver sufficient carrier power to the downconverter and demodulator. The G/T analysis considers the total received noise due to the antenna, waveguide, low noise amplification, and subsequent stages. This is evaluated against the net antenna gain as measured at the same reference point in the earth station RF receive section. The gain budget technique is then used to verify signal level in the same manner as for the uplink." - The Satellite Communication Ground Segment and Earth Station Handbook

$No = k*Teq*B$

No = noise spectral density in watts per hertz
k = boltsman's constant
Teq = equivalent noise temperature in Kelvin
B = bandwidth of interest

$Tsys = (Ta/Lr) + ((Lr-1)/Lr) * 290 + Tre$

Ta = antenna temperature
Lr = the loss factor for the input receive waveguide or transmission line, and is greater than or equal to 1
290 = assumed physical temperature of the waveguide
Tre = equivalent noise temperature of the receiver including noise added by stages downstream of the LNA.

It is critical to control waveguide loss and to use low noise amplifiers.

Antenna temperature for reflector antennas is generally under 50K for dishes larger than about 40 wavelengths.

E.g. 3m at C band. We have to limit to 1m. What is the effect on the noise temperature when you reduce the diameter of the reflector to 1/3 of the diameter quoted in the book?

The situation for very broad-beam antennas such as those used for mobile communications is that antenna temperature is often greater than Tre. A simple mobile antenna will allow ground noise to enter at nearly the same gain as the desired signal.

G/T budget

The evaluation of G/T at this point is the ratio of the gain to the system noise temperature measured at the same point in the receiving system. For example, at the input to the LNA. Remember to reduce the antenna gain by the amount of waveguide loss.