**The University of New Mexico**

**School of Engineering**

**Electrical and Computer Engineering Department**

**ECE 535 Satellite Communications**

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Module # 12-2: 12.15, 12.19, 12.21, 12.23, 12.25

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**12.15 An amplifier having a noise temperature of 200 K has a 4-dB attenuator connected at its input. Calculate the effective noise temperature referred to the attenuator input.**

A close-up of a sign

Description automatically generated

**12.19 Explain what is meant by carrier-to-noise ratio. At the input to a receiver the received carrier power is 400 pW and the system noise temperature is 450 K. Calculate the carrier-to-noise density ratio in dBHz. Given that the bandwidth is 36 MHz, calculate the carrier-to-noise ratio in decibels.**

Definition: Carrier-to-noise ratio is a measurement of the performance of a satellite link to the received input. Link budgets are typically concerned with solving this ratio (C/N).

**(a) Carrier-to-Noise Density Ratio in dBHz**

**(b) Calculate Carrier-to-Noise Ratio in Decibels at 36MHz Bandwidth**

**12.21 In a satellite link the propagation loss is 200 dB. Margins and other losses account for another 3 dB. The receiver [G/T] is 11 dB, and the [EIRP] is 45 dBW. Calculate the received [C/N] for a system bandwidth of 36 MHz.**

(a) Calculate the received [C/N] for a system BW of 36MHz

Boltzmann’s constant (J/K dB) for temp = 228.6 decilogs

C/N0 = EIRP + k + Gr - LProp – La = 81.6dB

[C/N0] = C/N0 – BW = 81.6dB – 10log(36MHz) = 6 dB

**12.23 Explain what is meant by saturation flux density. The power received by a 1.8-m parabolic antenna at 14 GHz is 250 pW. Calculate the power flux density (a) in W/m2 and (b) in dBW/m2 at the antenna.**

Definition: Saturation flux density (Ψs) is required at the receiving antenna to produce saturation of the TWTA (traveling-wave tube amplifier). It is the maximum flux that a material can support before it becomes saturated. Antennas can hold a calculated amount of magnetic field before saturating.

(a) Power flux density in W/m2

(b) Power flux in dBW/m2

= 10log(178.6x10-12) = -97.5 dBW/m2

**12.25 A satellite transponder requires a saturation flux density of -110 dBW/m2, operating at a frequency of 14 GHz. Calculate the earth station [EIRP] required if total losses amount to 200 dB.**

EIRP = (-110dBW/m2) + (-44.38dB) + 200dB = 45.6dBW