EC597 – WIRELESS COMMUNICATIONS ELECTRONICS
SU00 - DRV

Homework#12 - Due NOON, Tuesday, 5 September with Linda Hawking, Bldg 14

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SIGNATURE

1. (DOUBLE VALUE) Consider a direct broadcast satellite (DBS) in a geosynchronous orbit (R=40,000 km) is used to bring NSTC formatted TV to central Indiana. The satellite transmitter radiates 1 w at 12 GHz through an antenna with a gain of 50 dB. The ground station antenna is characterized by $G_R$=35 dB and $T_{ant}$=30 ºK. The receiver consists of a low-noise amplifier (LNA) with $T_{LNA}$=50 ºK and $G_{LNA}$=50 dB followed by a mixer with a conversion loss of $L_{MIXER}$=6 dB and noise figure $F_{MIXER}$=6 dB, and a high-gain, IF amplifier. The baseband TV signal with a bandwidth of 4.2 MHz is frequency modulated to an RF bandwidth of 36 MHz.
   A. Calculate the EIRP of the satellite system.
   B. Calculate the power density ($w/m^2$) of the signal reaching the receiver.
   C. Calculate the effective input noise temperature of the receiver.
   D. Calculate the CNR for the system referred to the input terminals.
   E. Calculate the SNR of the output signal.

2. An acceptable video signal requires SNR>40 dB
   A. For the system of problem 1, what satellite power level is required to achieve this value?
   B. Alternatively, for the system of problem 1, what receiver antenna gain is required to achieve this value? What diameter receiving antenna dish does this require?

3. An AM signal represented by $x_{AM}(t)=\cos(2\pi 10^8 t)[1+0.5\sin(2\pi 10^3 t)]$ μV is applied to the input to a spectrum analyzer with an input impedance of 50 Ω.
   A. Specify the span, resolution bandwidth, peak power level (in dB) to display this signal. Assume the vertical display is calibrated in 10 dB/division and 6 divisions are displayed.
   B. Sketch the resulting display for the settings of part A.