

## Homework #3 (Due on 12:00am, Thursday, Nov. 14th, 2013)

### 1 Pathloss with different wireless technologies

Consider a Jennic sensor node with 3dBm transmission power (antenna gain 0dBi), a mobile station that transmits at 2W in GSM (antenna gain 0dBi), a GSM base station that transmits at 10W (antenna gain 3dBi), a DAB (digital audio broadcasting) transmitter with 1 kW EIRP (230 MHz), a DVB-T (digital video broadcast) transmitter with an EIRP of 10kW (800 MHz). Furthermore, consider a Bluetooth transmitter with 2.5 mW EIRP (2.4GHz) and a Wlan transmitter with 100mW EIRP (2.4GHz).

Calculate the signal strength at a receiver at a distance of

1. 10cm
2. 1m
3. 1km
4. 10km

Assume that the receiver has an antenna gain of 0dBi.

Note: Antenna gain of a DVB-T roof-mounted antenna with 800MHz: 12dB. Indoor antenna: -2 to 0 dB)

### 2 CDMA encoding and decoding

Consider four senders A, B, C, and D. Which are assigned the following chip sequences:

$$A_{\text{chip}} = 11110000$$

$$B_{\text{chip}} = 11000011$$

$$C_{\text{chip}} = 10011001$$

$$D_{\text{chip}} = 10010110$$

The data sequences to transmit are

$$A_{\text{data}} = 00$$

$$B_{\text{data}} = 11$$

$$C_{\text{data}} = 10$$

$$D_{\text{data}} = 01$$

- a) Please calculate the combined and encoded sequence obtained at a receiver
- b) Demonstrate the decoding of the respective sequences at the four receive nodes

### 3 Thermal noise

Estimate the thermal noise in an indoor environment (assume a room temperature of 20°C) for a 1Mhz signal.

### 4 CSMA/CA

How does CSMA/CA tackle the problem of collisions (what steps are taken at the sender and receiver respectively)?