Exercises - MWC 2019

CHAPTER 2: CHARACTERISTICS OF RADIO ENVIRONMENT

I. PROPAGATION MODELS

Problem 1.1.

City	n_1	n_2	$d_b(m)$
London	$1.7 - 2.1$	$2 - 7$	$200 - 300$
Melbourne	$1.5 - 2.5$	$3 - 5$	150
Orlando	1.3	3.5	90

Plot $P_{R,dB} - P_{T,dB}$ for Orlando as a function of distance d, in meters, with $0 < d < 200$(m). Assume transmitter and receiver antenna gains are both 1; average power effect is experienced, two-slope model is used.

Problem 1.2.

The average power received at mobiles 100m from a base station is 1mW. Log-normal, shadow, fading is experienced at that distance. The log-normal standard deviation σ is 6dB.

(a) What is the probability that the received power at a mobile at that distance from the base station will exceed 1 mW? Be less than 1 mW?

(b) An acceptable received signal is 10 mW or higher. What is the probability that a mobile will have an acceptable signal?

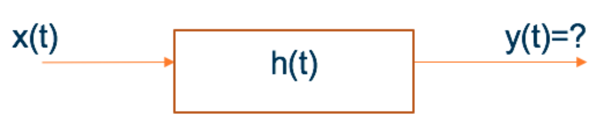
(c) Repeat for $\sigma = 10dB$

(d) Repeat both cases for an acceptable received signal of 6mW.

II. RANDOM CHANNEL CHARACTERIZATION

Problem 2.1.

Determine output signal of below system:

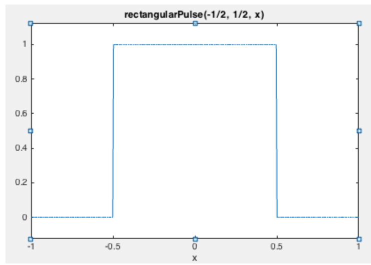


$$x(t) = e^t * [u(t-1) - u(t-3)]$$

$$h(t) = \delta(t - 1)$$

Determine transfer function of the system.

Note: $u(t)$ is a rectangular function



III. FADING

Problem 3.1.

Consider several a delay spread of $0.5\mu s$, $1\mu s$, $6\mu s$. Determine whether individual multi-path rays are resolvable for the two transmission bandwidths:

- 1.25MHz used in IS-95 and cdma2000
- 5MHz used in WCDMA

Note:

Relation between bandwidth (B) and symbol interval (T) according to Fourier analysis

$$B.T = 1$$

Problem 3.2.

Indicate the condition for flat fading for each of the following data rates with transmission in binary form: 8 kbps, 40 kbps, 100 kbps, 6 Mbps. Indicate which, if any, radio environments would result in flat fading for each of these data rates.