ELEX 7860 : Wireless System Design
2021 Winter Term

Quiz 3
1:30 – 2:20 PM
Thursday, April 1, 2021

This quiz has three (3) questions on four (4) pages. The marks for each question are as indicated. There are a total of twelve (12) marks.
Download this quiz and write your answers in the space provided. You may print the quiz and write the answers by hand, mark up this document using a tablet, or edit the file with a word processor. Books and notes are allowed but you may not communicate with anyone else during the quiz.
Please sign the following declaration to confirm your understanding of this:

> This work is solely my own effort and I understand the consequences of plagiarism and other offences described in BCIT Policy 5104.

Signed: _____

Answer all questions. *Show your work.* Draw a box around your final answer. Numerical answers must include units.
When you are done, export your document to a **PDF** file. Submit the PDF file to the Quiz 3 Assignment folder on the course web site before the submission deadline, 2:20 PM . If you submit multiple times only the most recent submission will be marked.
Only PDF files will be marked.

Name: _____

BCIT ID: _____

Question	Mark	Max.
1		3
2		6
3		3
Total		12

Question 1 — 3 marks

A communication system using OFDM will operate over a channel with a delay spread of 100 ns.

(a) For the OFDM signal bandwidth to be equal to the inverse of this delay spread, what is the minimum (complex) sampling rate that could be used?

(b) If the guard time is to be equal to ten times the delay spread, what is the duration of the cyclic extension in units of samples, assuming the sample rate above?

(c) If the OFDM symbol size is $N = 256$ samples, what is the subcarrier spacing?

Question 2 — 6 marks

A wireless system operating at 3 GHz uses 1 W transmit output power and an antenna with 15 dBi gain. The receiver is 8 km away and you can assume free-space loss. You can neglect feedline and other losses. The constant kT is -174 dBm/Hz, the noise figure is 2 dB, and the receiver bandwidth is 1.6 MHz (62 dB-Hz). The system requires an SNR of 25 dB to provide service.

Prepare a link budget for this system that takes into account the factors mentioned above. Include: (a) the computed path loss in dB, (b) received signal power in dBm, (c) received noise power in dBm, (d) received SNR in dB, and (e) the link margin in dB. Will this system provide service?

Question 3 — 3 marks

The following “mask” shows the maximum allowed level of the in-channel and adjacent-channel signals transmitted by a device. The in-channel output power should be 20 dBm. What would be the minimum required OIP3 rating for the device’s final RF amplifier?