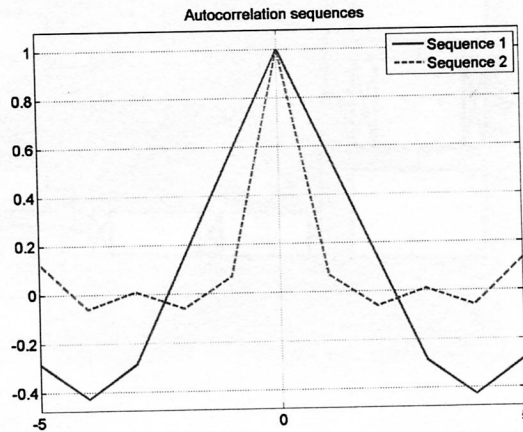


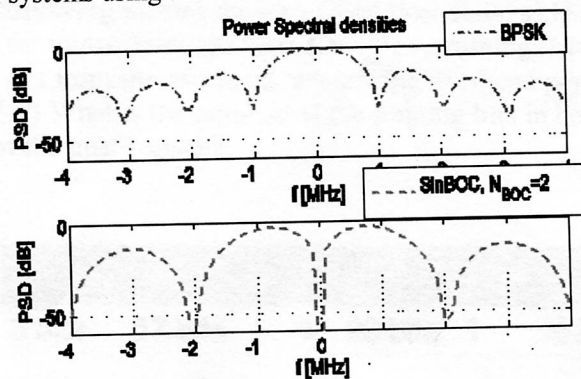
konstantin.nykov@tut.fi

TLT-6106 Basic Course on Wireless Communications, Exam February 2012, Please give the answers in English. Students' own calculators or faculty's calculators are allowed. The attached 2-page formulas are allowed. Exam's compiler: Danai Skournetou TG214.

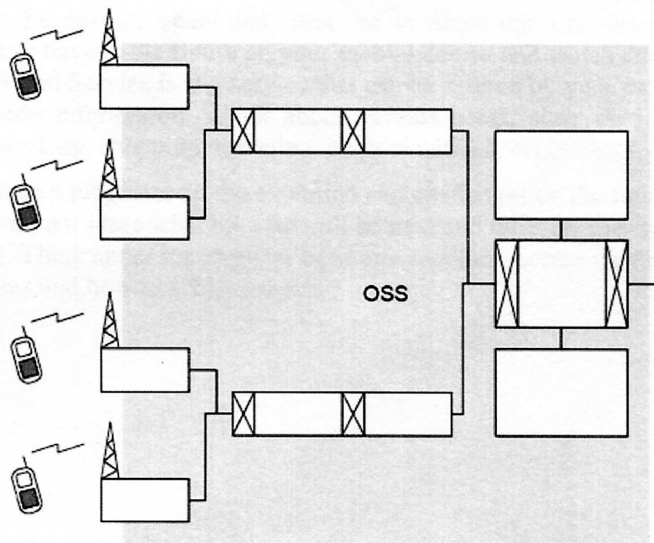
1. a) (3p) In the following plot, the autocorrelation of two CDMA code sequences are shown. Show which sequence has better auto-correlation properties and explain why. Explain what properties are important for the code sequences used in CDMA.



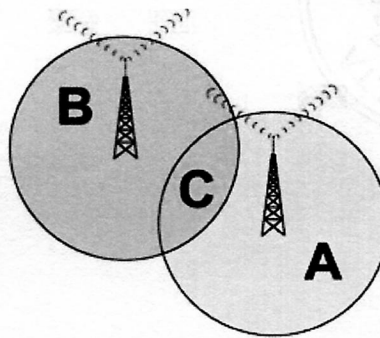
- b) (3p) What is the meaning of Inter-Symbol Interference (ISI) and which are some methods to cope with ISI? (Explain briefly at least 2 methods). Add an illustrative example about ISI.
2. a) (3p) Describe the principles of OFDM modulation/multiple access; give example of one system which employs OFDM; explain via an illustration in frequency domain how the resistance against narrowband interference is achieved.
- b) (3p) Describe Bluetooth technology. Briefly compare WPAN with WLAN
3. a) (3p) The following figure shows the spectra of a BPSK and a BOC(1,1)-modulated signal, respectively. Based on this figure, what can you say about the interference between the 2 signals? How is this interference compared with the interference between 2 BPSK-modulated signals? How the spectral splitting is achieved for BOC modulation? Give examples of systems using these modulations.



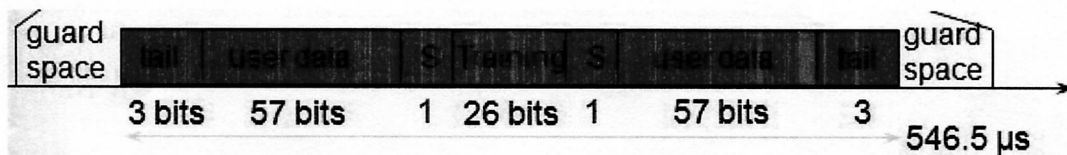
- b) (3p) Based on the following block diagram, explain the basic architecture of a GSM system. Which is the functionality of each blank block shown in the figure below? (fill in the blank spaces with the names of the corresponding block).



4.a) (2p) Based on the following figure, explain the concept of co-channel interference in cellular communications.



b) (2p) The following picture shows a GSM time slots. a) How many bits are allocated for transmitting the user data? B) Assuming that all the bits that are not user data bits form the overhead, what is the overhead per user-data ratio in this example? C) What is the purpose of the training bits in here? D) What is the purpose of the guard space?



c) (2p) Describe briefly the GPS system in terms of architecture (segments), signals and spectra, principle of positioning, advantages and limitations of performance (e.g., sources of errors), example of applications

5.a) (3p) Describe your view regarding the evolution of wireless positioning on mobile devices in the next 20 years and describe in detail one Location Based Service that you would like to have in the future on your mobile device and which does not exist nowadays. A Location Based Service is any service that can be offered by your mobile operator which uses your location information. Think about various areas, such as: infotainment, emergency, social networking, shopping, traveling, crisis situations, etc.

b) (3p) Make a judgment on the evolution and challenges on the future wireless networks (write down your ideas what on what will be next and what are the challenges we have to cope with). Think about the physical layer and Medium Access Control (MAC) layer requirements and how to achieve them.

