

Çankaya University – ECE Department – ECE 376

2013 Spring Term

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Experiment 9 : OFDM

MATLAB code, OFDM_Exp9.m available on course webpages

1. This experiment is intended to show you OFDM modulation and demodulation. For this purpose it uses 8 QAM to modulate the eight OFDM subcarriers, $c_1(t) \cdots c_8(t)$. The related 8 QAM constellation is shown on the next page. Which symbols are assigned to which subcarriers depend on the symbol time flow from the QAM modulator.
2. When run, the m file generates four graphs and the correlation matrix on the workspace showing orthogonality between subcarriers.
3. On line 34, it is also possible to arrange the time flow of 8 QAM symbols that will modulate the OFDM subcarriers. Then on line 43, we select which symbol to demodulate. Presently on these lines, the time flow of 8 QAM symbols and their assignments to OFDM subcarriers are arranged as $[\underbrace{s_1}_{c_1(t)} ; \underbrace{s_2}_{c_2(t)} ; \underbrace{s_3}_{c_3(t)} ; \underbrace{s_5}_{c_4(t)} ; \underbrace{s_6}_{c_5(t)} ; \underbrace{s_8}_{c_6(t)} ; \underbrace{s_7}_{c_7(t)} ; \underbrace{s_4}_{c_8(t)}]$. With this arrangement, at receiver, correlating (on line 43) the sum of such modulated signals with $c_4(t)$, we expect to demodulate, s_5 whose result is also written on the workspace.
4. By using this Matlab code and the graphs generated, write for the time waveform of subcarriers $c_1(t) \cdots c_8(t)$, including the subcarrier frequencies and the respective phases. Determine the OFDM symbol duration T . Test whether the subcarriers satisfy the orthogonality conditions.
5. By changing the setting of T on line 4 of the code, thus violating the orthogonality condition, observe what happens to subcarrier waveforms, the spectrum of subcarriers, the correlation matrix written out onto the workspace and demodulated symbol at receiver. Incorporate these findings into your report.
6. Comment on the spectrum of modulated subcarriers.
7. By changing the time flow of symbols and the particular symbol to be demodulated, given in 3., observe that the demodulations functions correctly in all cases.
8. Include all waveforms and spectrums generated by the Matlab code in your report.

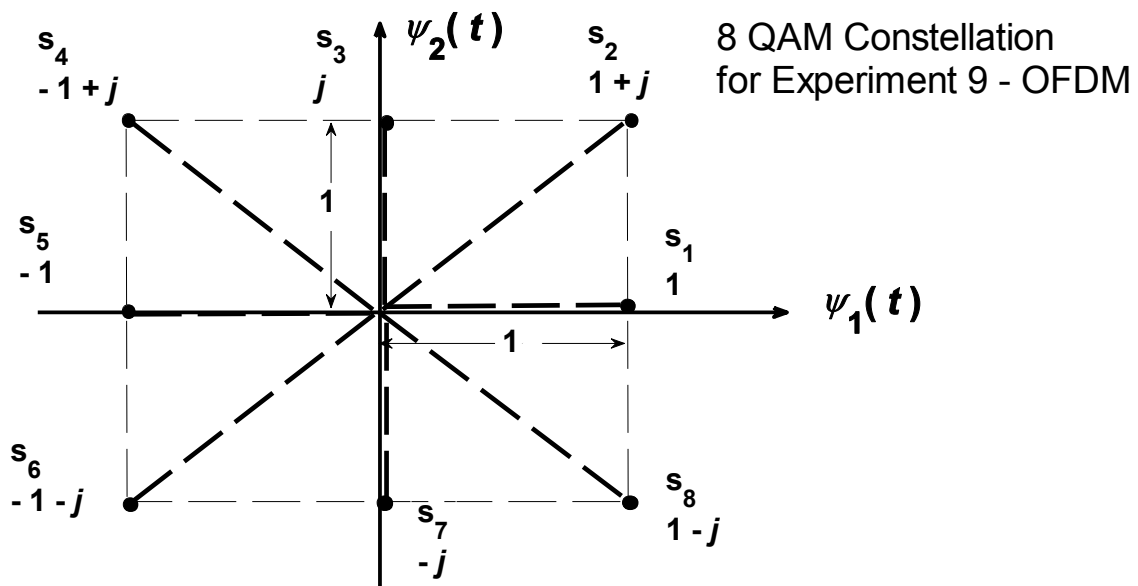


Fig. 1 The signal vector positions in the 8 QAM constellation used to modulate OFDM subcarriers in experiment 9.