EE 6390-Introduction to Wireless Communications Systems

Spring-2012

Project Report

MATLAB Simulation of Simplified LTE OFDM

Submitted by,

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Abstract

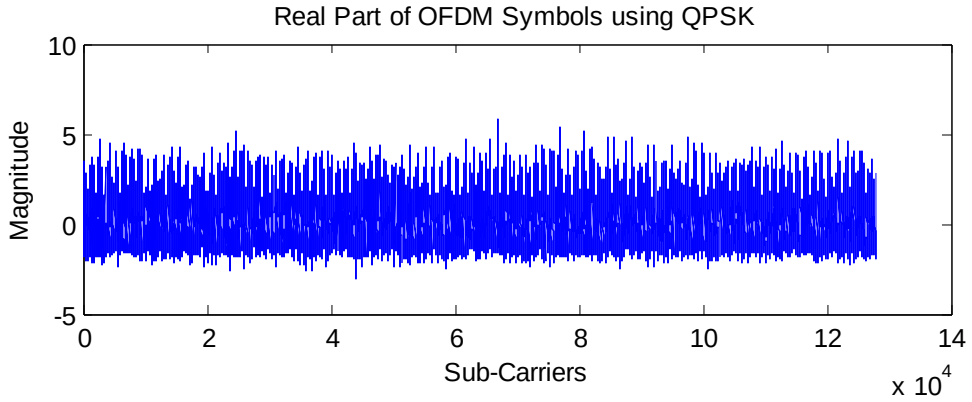
This project deals with the Matlab implementation of orthogonal frequency division multiplexing technique and its analysis in AWGN and three other different multipath channels. The performance of QPSK, 8-PSK and 16-QAM modulation techniques are simulated under three different multipath channel. The spectral efficiency of the OFDM technique is also studied under the effect of channel.

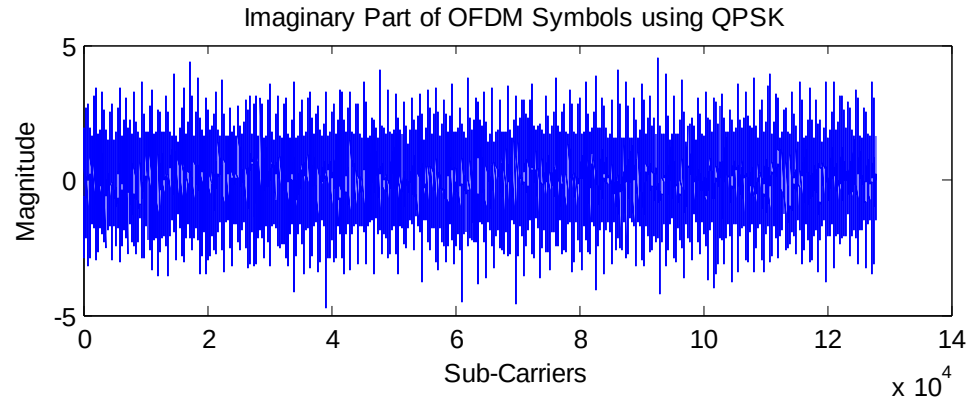
Operation:

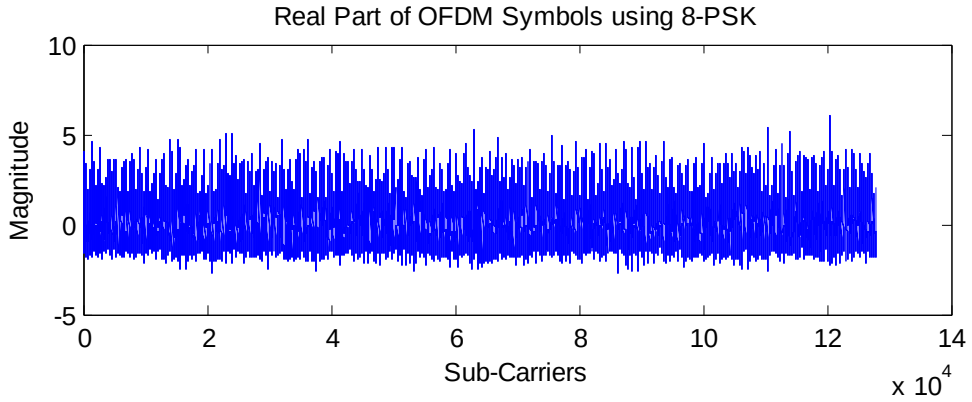
OFDM divides the data into a number of parallel sub streams, each stream modulated on an orthogonal subcarrier thereby reducing ISI and also maintaining the required data rate. The project is simulated with the following parameters:

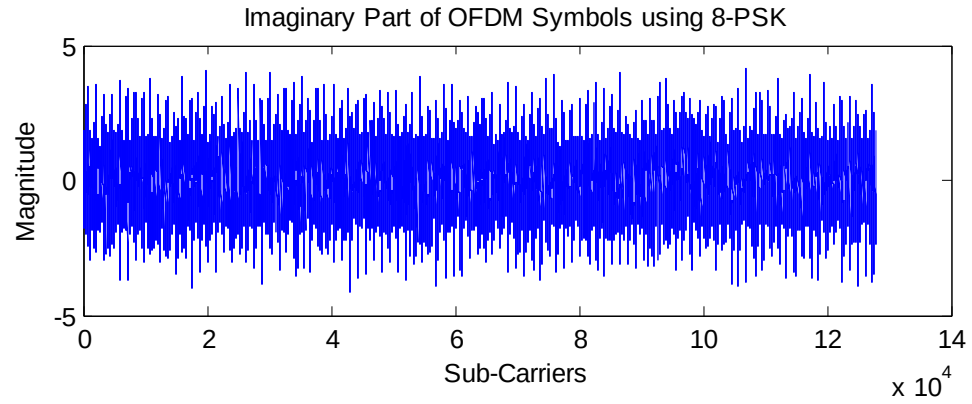
1. FFT Size=1024
2. Cyclic prefix size=256
3. Data Sub-Carriers=720
4. Pilot Sub-Carriers=720/6=120
5. Null Sub-Carriers=184
6. N-left+N-right+N-dc=184
7. Modulations used are QPSK, 8-PSK, 16-QAM.

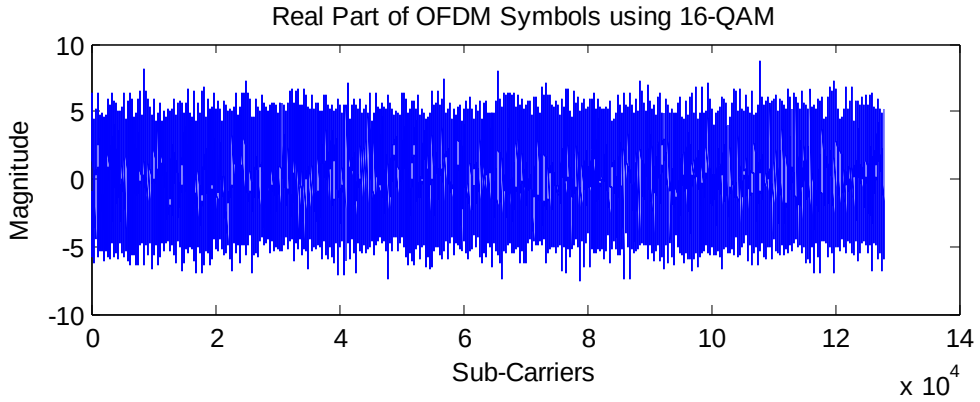
The Results of the Project are shown below

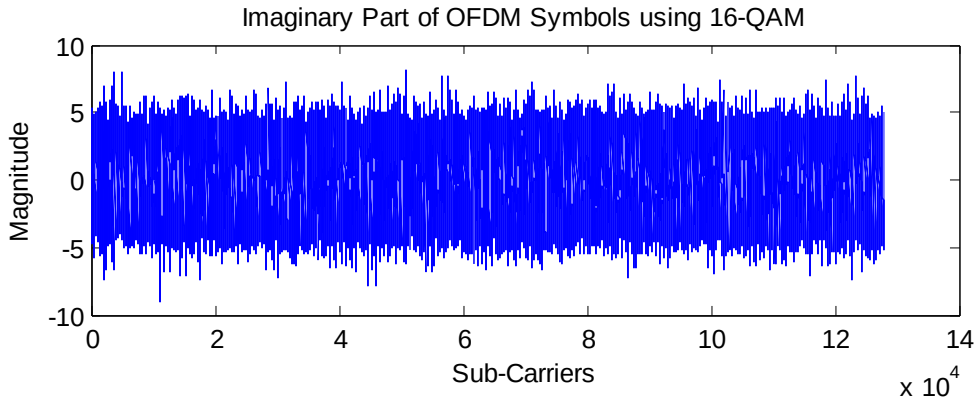

Real Part of OFDM Symbols using QPSK
Magnitude
Sub-Carriers
x 10^4

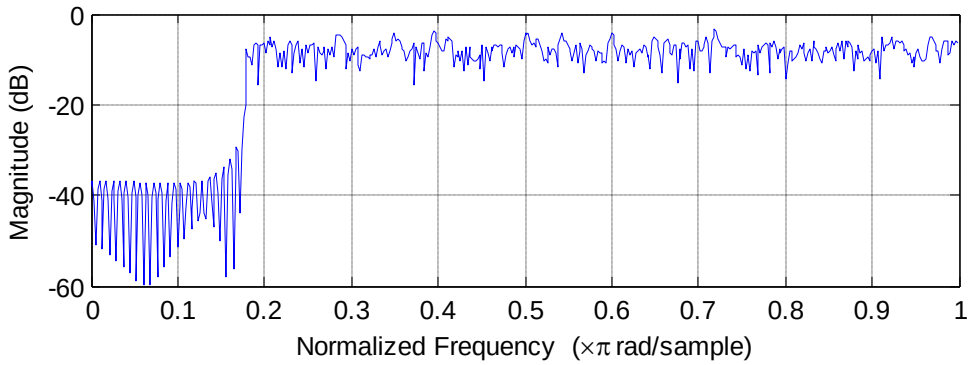

Imaginary Part of OFDM Symbols using QPSK
Magnitude
Sub-Carriers
x 10^4

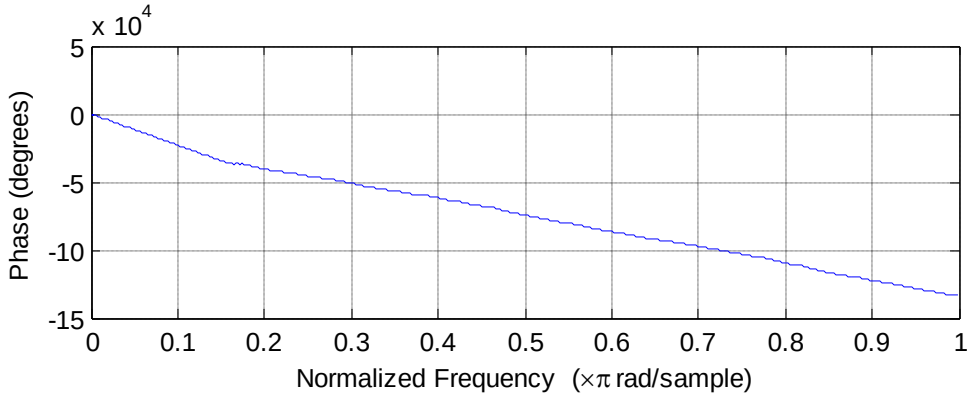

Real Part of OFDM Symbols using 8-PSK
Magnitude
Sub-Carriers
x 10^4

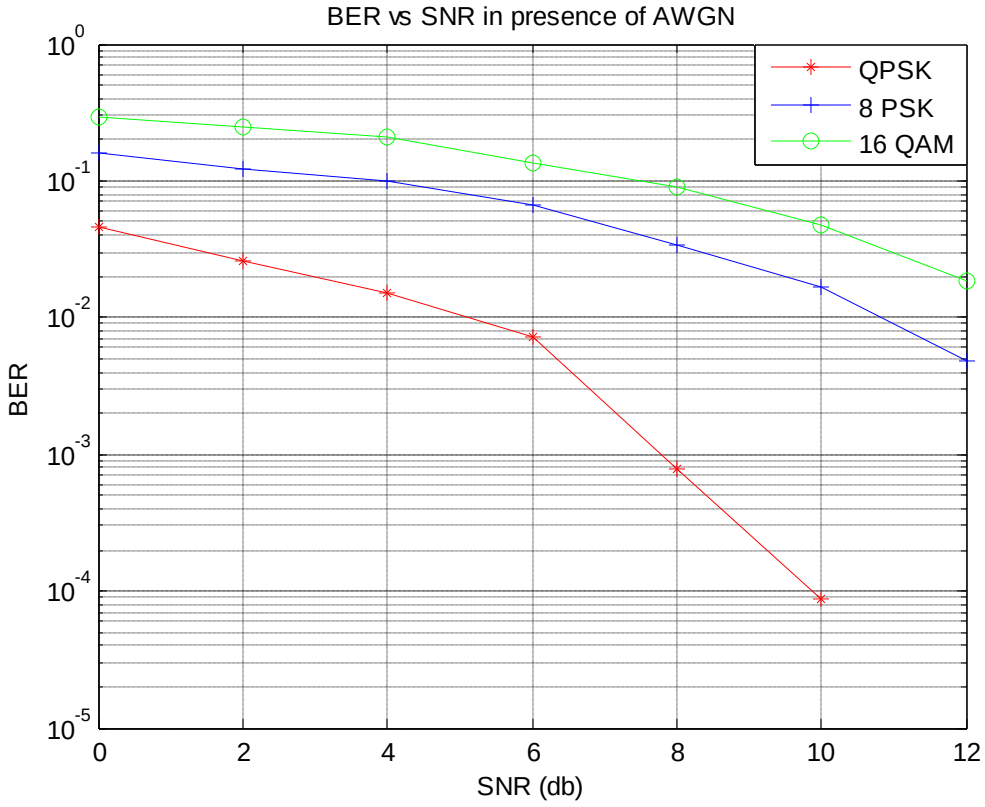

Imaginary Part of OFDM Symbols using 8-PSK
Magnitude
Sub-Carriers
x 10^4

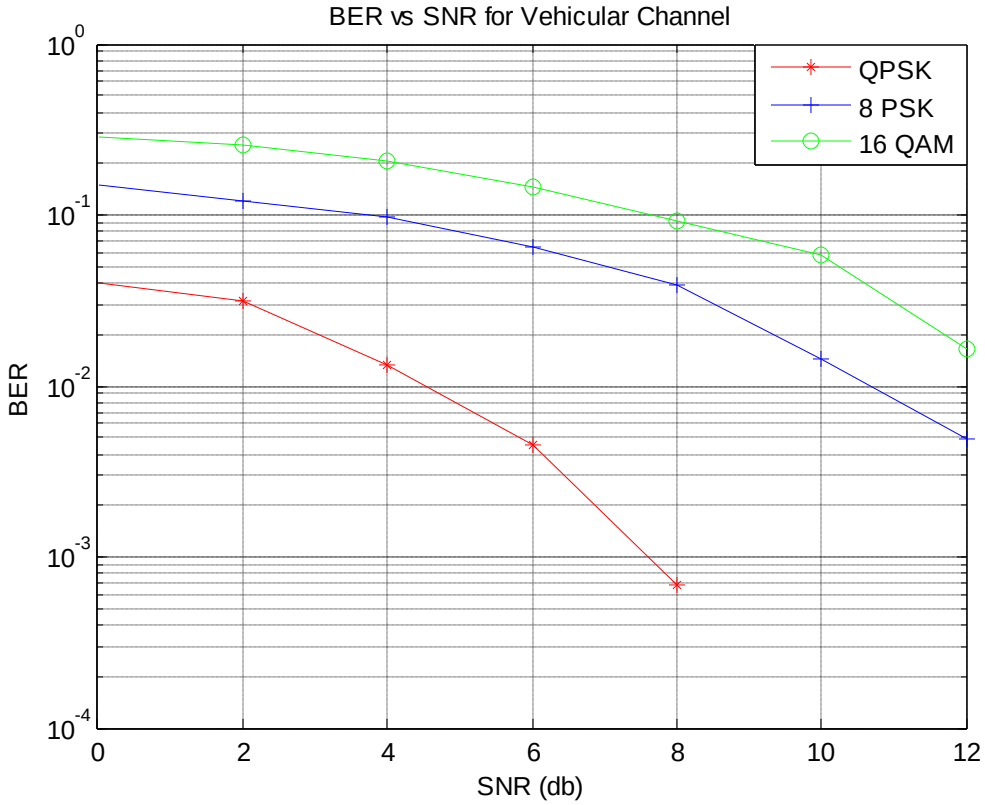

Real Part of OFDM Symbols using 16-QAM
Magnitude
Sub-Carriers
x 10^4

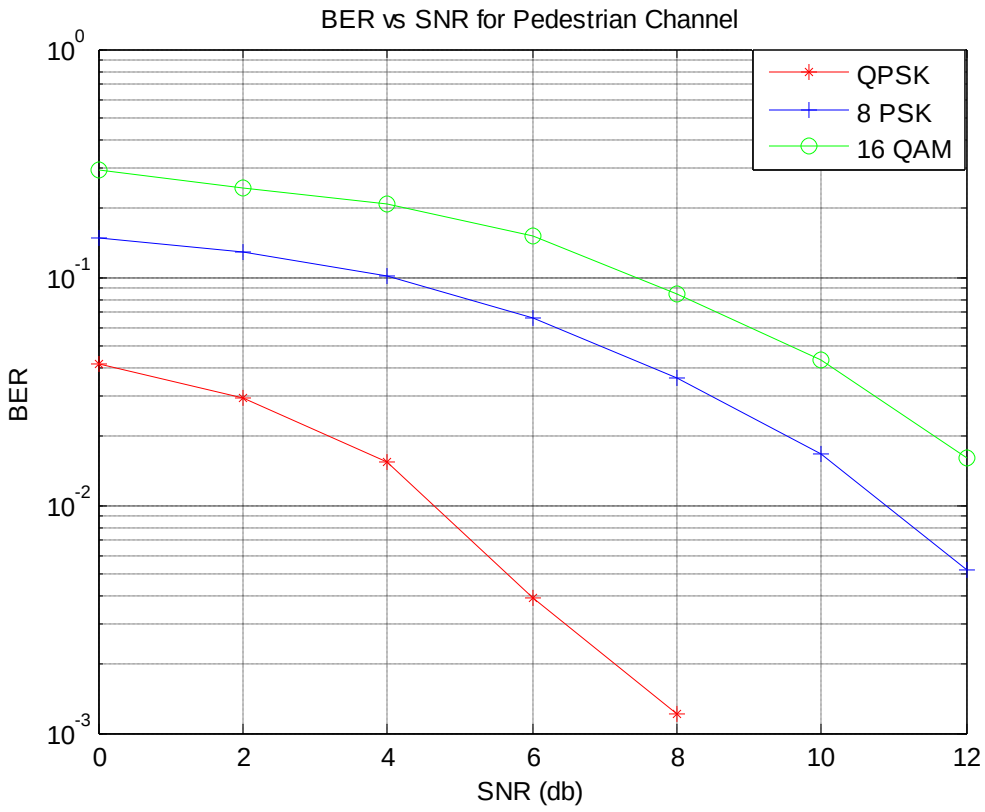

Imaginary Part of OFDM Symbols using 16-QAM
Magnitude
Sub-Carriers
x 10^4

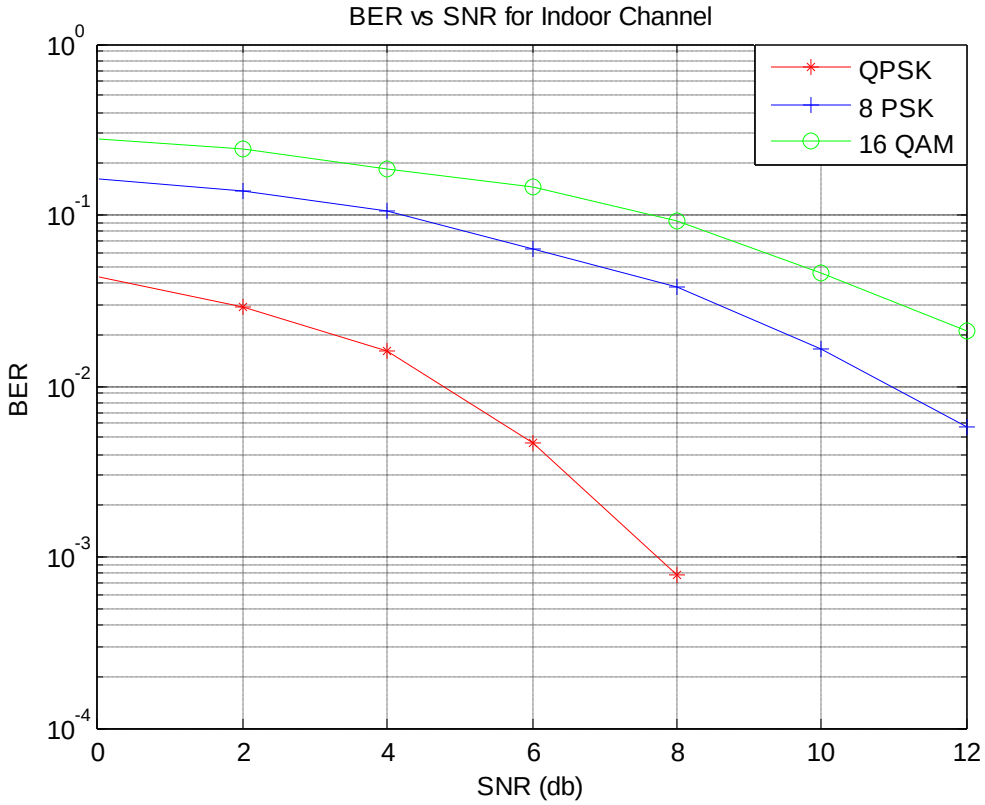

Magnitude (dB)
Normalized Frequency (×π rad/sample)

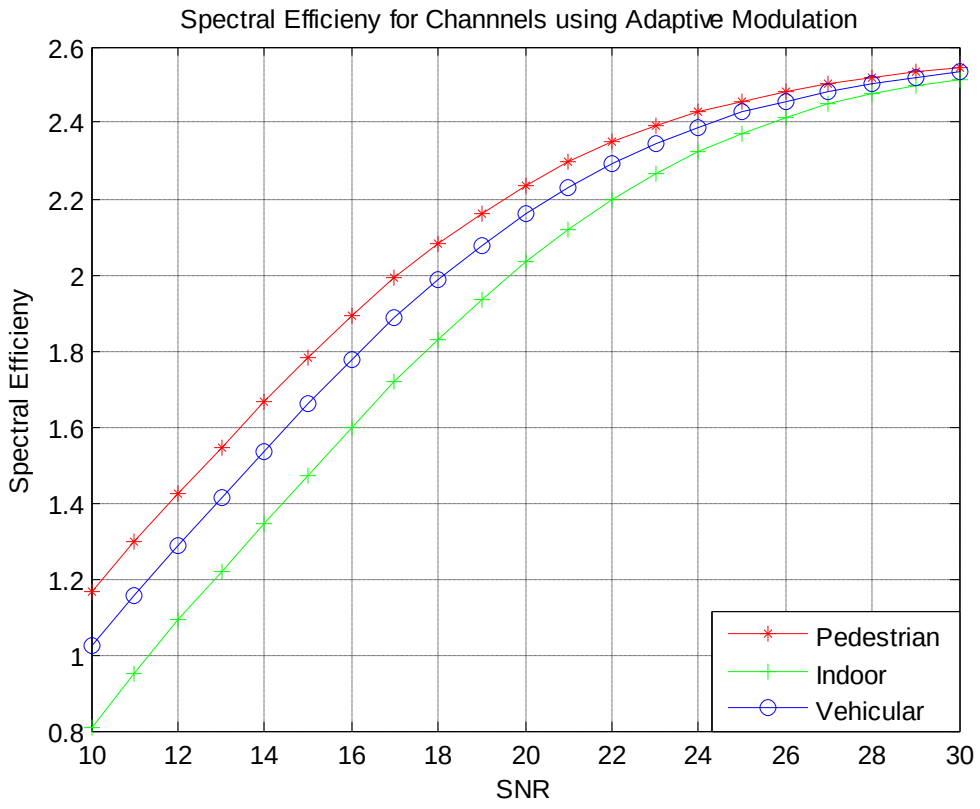

x 10^4
Phase (degrees)
Normalized Frequency (×π rad/sample)


BER vs SNR in presence of AWGN
QPSK
8 PSK
16 QAM
BER
SNR (db)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
0
2
4
6
8
10
12


BER vs SNR for Vehicular Channel
QPSK
8 PSK
16 QAM
BER
SNR (db)
10^0
10^-1
10^-2
10^-3
10^-4
0
2
4
6
8
10
12


BER vs SNR for Pedestrian Channel
BER
SNR (db)
QPSK
8 PSK
16 QAM
10^0
10^-1
10^-2
10^-3
0
2
4
6
8
10
12


BER vs SNR for Indoor Channel
BER
SNR (db)
QPSK
8 PSK
16 QAM
10^0
10^-1
10^-2
10^-3
10^-4
0
2
4
6
8
10
12


Spectral Efficieny for Channnels using Adaptive Modulation
Spectral Efficieny
SNR
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
10
12
14
16
18
20
22
24
26
28
30
Pedestrian
Indoor
Vehicular