```
clear
close all
clc
% setup
BW = 20e6;
N_c = 1024;
channel_profile = [0e-9 0.485; 310e-9 0.3852;
 710e-9 0.0611; 1090e-9 0.0485; 1730e-9 0.0153; 2510e-9 0.0049];
% QAM order ( 4 / 16 / 64 )
M = 4;
% bits per symbol
bps = log2(M);
% random binary signal
N_b = 720000;
x_b = randi([0 1],1,N_b);
% bits to symbols
N_s = N_b / bps;
x_s = zeros(1, N_s);
index = 1;
for i=1:bps:N_b
 accumulator = 0;
 for n=0:1:bps-1
   accumulator = accumulator + (x_b(i+n))*(2^n);
 x_s(index) = accumulator;
 index = index + 1;
end
% QAM
y = qammod(x_s, M, 'PlotConstellation', true);
% Multi-path Channel Loop
```

```
received Symbols = [];
N_OFDM_Symbols = N_s/N_c;
% channel loop
for OFDM_Symbol = 1:1:N_OFDM_Symbols
  index = (OFDM Symbol - 1)*N c + 1;
  current_OFDM_Symbol = y(index:1:index+N_c-1);
  rayleighCoefficients = getChannelCoefficients(N_c, BW, channel_profile);
  faded_OFDM_Symbol = current_OFDM_Symbol.*rayleighCoefficients;
  noisy_OFDM_Symbol = awgn(faded_OFDM_Symbol, 30);
  equalized_OFDM_Symbol = noisy_OFDM_Symbol./rayleighCoefficients;
  received Symbols = [received Symbols equalized OFDM Symbol];
end
% demodulation
x_s_received = qamdemod(received_Symbols, M);
% symbols to bits
binary_received = zeros(1, length(x_b));
for i=1:1:N_s
  temp = de2bi(x_s_received(i), bps);
  binary_received((i-1)*bps+1:1:(i-1)*bps+bps) = temp;
end
% results
BER = sum(xor(binary_received,x_b))/N_b
color = "yellow";
colors = repelem(color, N_s);
scatfig = scatterplot(received_Symbols);
xlim([-bps bps])
ylim([-bps bps])
title("Scatter Plot of Received Symbols")
grid on;
ax = gca;
ax.LineWidth = 2;
```

```
Index exceeds the number of array elements (359424).
Error in ofdm (line 98)
   temp = de2bi(x_s_received(i), bps);
```

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