

```
M = 2 % Number of Bits per Symbol
```

```
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```

```
BAUD_RATE = 1 % Symbols transmitted per second
```

```
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```

```
L = 50 % Number of Symbols to be transmitted
```

```
L = 50
```

```
SAMPLING_RATE = 20 % Samples per second in Khz
```

```
SAMPLING_RATE = 20
```

```
Fc = 1 % Carrier Frequency in Khz
```

```
Fc = 1
```

```
Ac = 1 % Carrier Amplitude
```

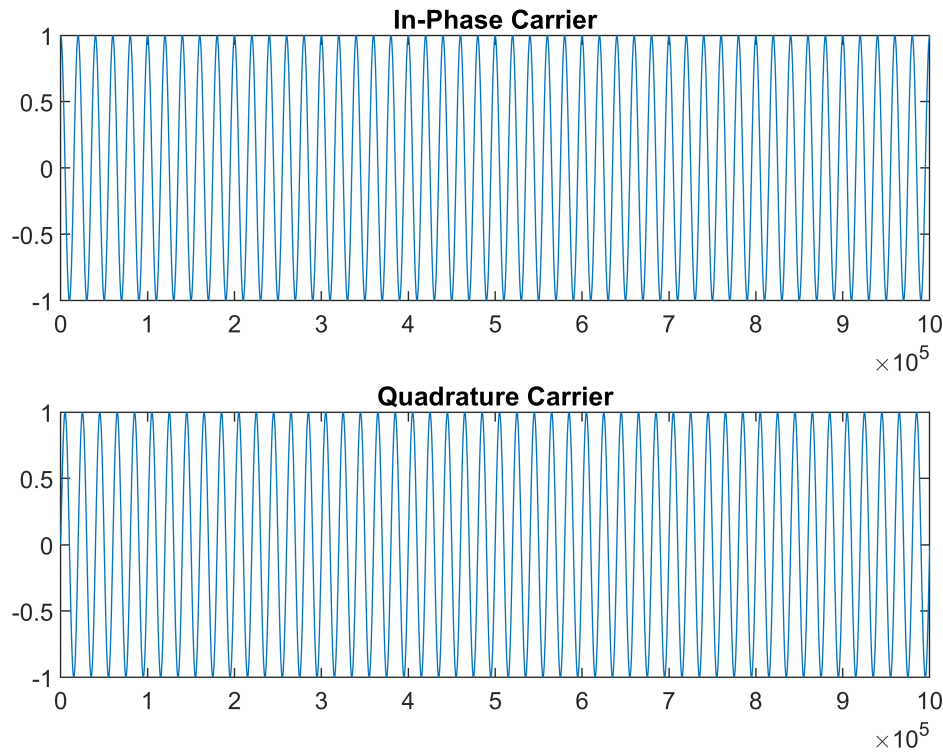
```
Ac = 1
```

```
T = L / BAUD_RATE; % tx signal length in seconds  
N = SAMPLING_RATE * T * 1000; % Number of samples required  
samples_per_symbol = N/L;
```

```
n = 0:N-1;  
in_phase = Ac*cos(2*pi*Fc*n/N*T);  
quadrature = Ac*sin(2*pi*Fc*n/N*T);
```

```
figure  
subplot(2,1,1)  
plot(in_phase)  
title("In-Phase Carrier")  
subplot(2,1,2)  
plot(quadrature)  
title("Quadrature Carrier")  
sgtitle("Carrier")
```

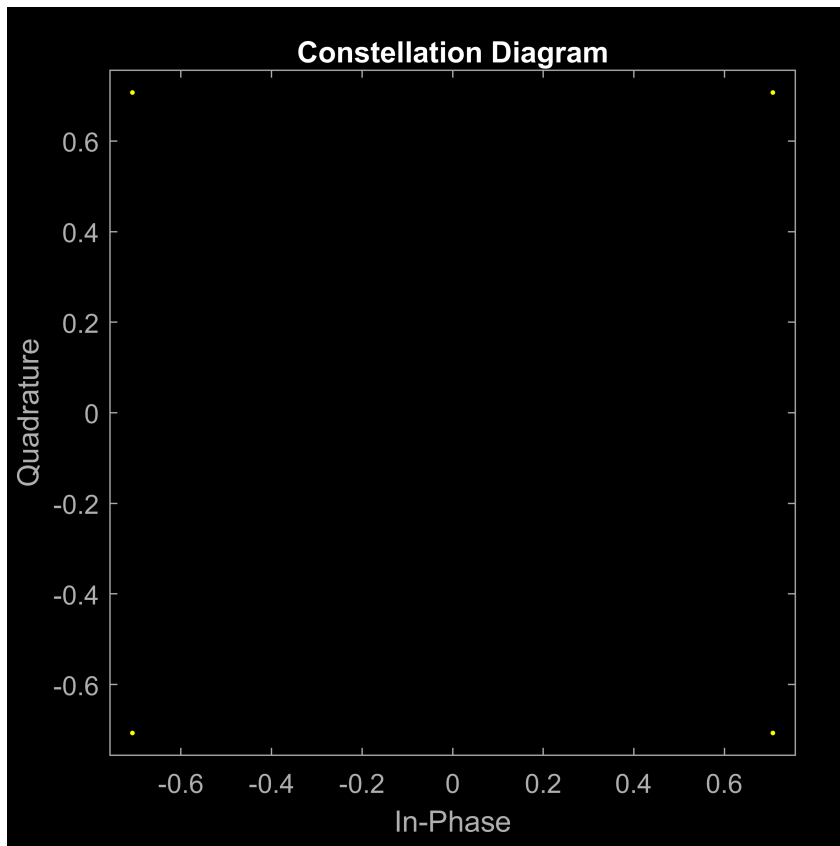
Carrier



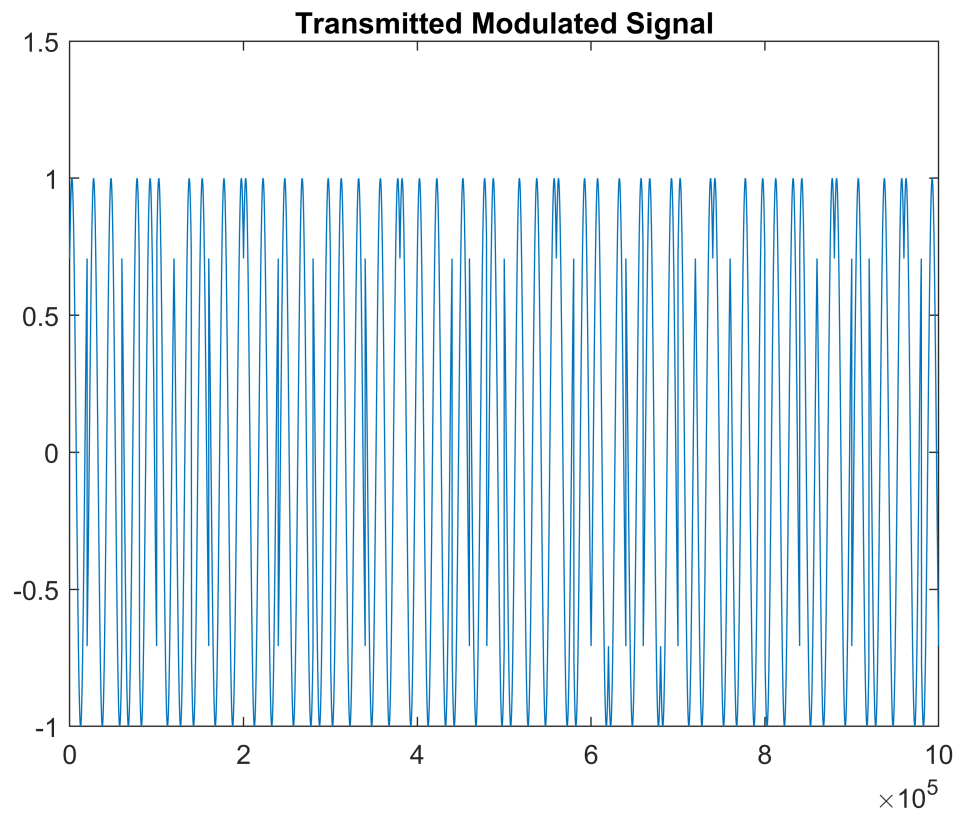
```
symbols = qammod(0:2^M-1,2^M,"UnitAveragePower",true);
message_signal = randi([0 2^M-1],L,1);
encoded_message_signal = zeros(L,1);

tx_signal = zeros(N,1);

for i = 1:L
    encoded_message_signal(i) = symbols(message_signal(i)+1);
    for j = 1:samples_per_symbol
        k = (i-1)*samples_per_symbol + j; % Index of the tx sample
        tx_signal(k) = real(encoded_message_signal(i)) * in_phase(k) + ...
            imag(encoded_message_signal(i)) * quadrature(k);
    end
end
figure
scatterplot(encoded_message_signal)
title("Constellation Diagram")
```



```
figure
plot(tx_signal)
title("Transmitted Modulated Signal")
```



```
% Passing through AWGN Channel
```

```
SNR = 25 % Db
```

```
SNR = 25
```

```
encoded_message_signal_with_noise = AWGN_Custom(encoded_message_signal,SNR);  
figure  
scatterplot(encoded_message_signal_with_noise)  
title("Message Symbols with Noise")
```

