```
close all; clearvars; clc

% Script for simulating the QPSK waveform transmitted over channel after SRRC
 filtering
% and the samples detected in reception after corresponding matched filtering
```

PARAMETERS

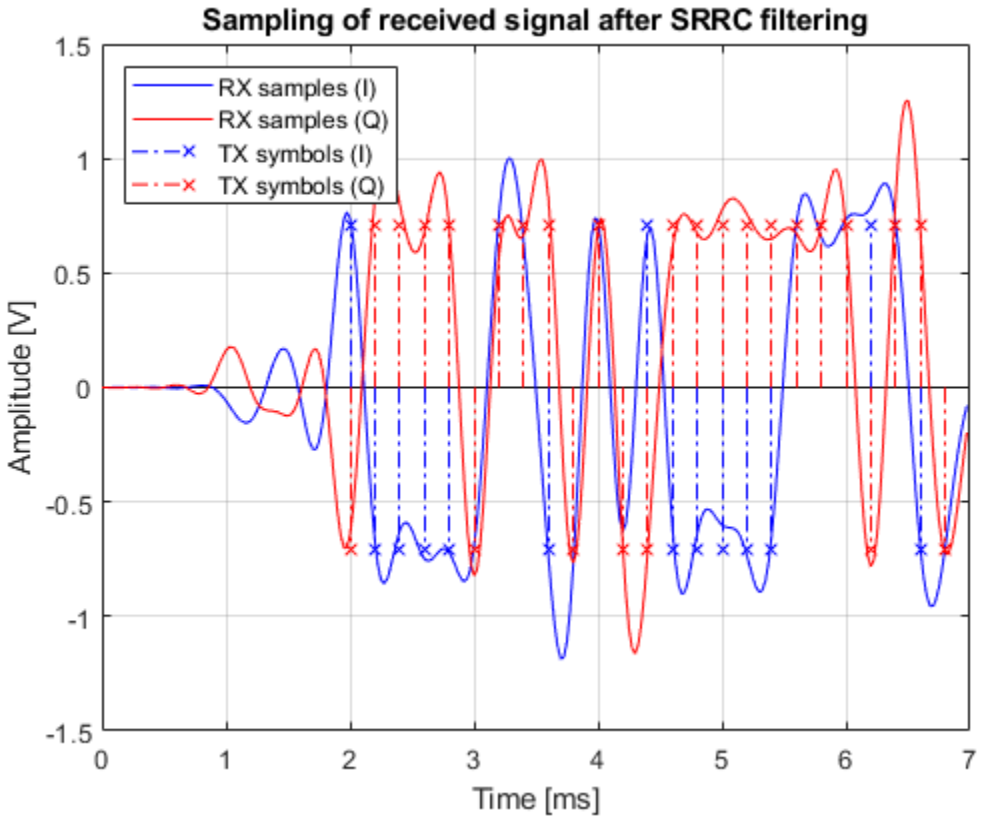
```
Nbits = 50;
  % Number of transmitted bits
DR = 10e3;
  % Data rate [b/s]
SNR = 20;
  % [dB] Signal-to-noise ratio per symbol (assuming Psgn=1W)
Tscale = 1000;
  % Time scale for waveform plot (e.g. for "ms" use Tscale = 1000)
Fc = 400e6;
  % [Hz] Carrier frequency

ResFact = 12e3;
M = 4;
  % Modulation order (4 for QPSK)
phase_offset = pi/4;
  % QPSK constellation phase offset
QPSK_MOD = comm.QPSKModulator('PhaseOffset',phase_offset,'BitInput', ...
 % QPSK modulator object
    true, 'SymbolMapping','Gray','OutputDataType','double');
beta = 0.3;
  % Roll-off factor for SRRC filter
span = 10;
  % Window span in samples for SRRC filter
sps = 8;
  % Number of samples per symbol for SRRC filter upsampling
SRRC_FILTER_TX = comm.RaisedCosineTransmitFilter('Shape','Square root', ...
 % SRRC TX filter object
  'RolloffFactor',beta,'FilterSpanInSymbols',span, ...
  'OutputSamplesPerSymbol',sps);
SRRC_FILTER_RX = comm.RaisedCosineReceiveFilter('Shape','Square root', ...
 % SRRC RX filter object
  'RolloffFactor',beta,'FilterSpanInSymbols',span, ...
  'InputSamplesPerSymbol',sps,'DecimationFactor',1);
SRRC_delay = span*sps;
  % Overall delay in samples introduced by TX-RX SRRC filters
SYR = DR/log2(M);
  % [s/s] Symbol rate
SAR1 = DR*sps/log2(M);
  % [S/s] Sample rate before up-resampling
```

SIMULATION #1(BASEBAND PROCESSING AND SAMPLING IN RX)

```
input_bits = randi([0,1],Nbits,1);
mod_symb = QPSK_MOD(input_bits);
SRRC_TX_symb = SRRC_FILTER_TX([mod_symb; zeros(span/2,1)]);
channel_symb = awgn(SRRC_TX_symb,SNR);
SRRC_RX_symb = SRRC_FILTER_RX([channel_symb; zeros(span*sps/2,1)]);

t1 = Tscale/SYR*(0:Nbits/log2(M)-1)+SRRC_delay*Tscale/SAR1;
t2 = Tscale/SAR1*(0:length(SRRC_RX_symb)-1);
figure;
box on; hold on
plot(t2,real(SRRC_RX_symb),'b',t2,imag(SRRC_RX_symb),'r')
stem(t1,real(mod_symb),'b-.x'); stem(t1,imag(mod_symb),'r-.x')
xlabel('Time [ms]'); ylabel('Amplitude [V]')
legend('RX samples (I)','RX samples (Q)', ...
'TX symbols (I)','TX symbols (Q)','Location','NW')
title('Sampling of received signal after SRRC filtering')
grid on
```



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