Digital Communication IC design   r13943124 施伯儒
HW3

1.
(a)~(c)
delay單位是ns

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>> answer1
Linear Power Ratios:
      1.0000      0.5012      0.3981      0.1585      0.0316

Mean Excess Delay:
     17.6019

RMS Delay:
     25.6092
```

2.

(a)

because of randomness, the result below may not be the same

```
>> answer2
Normalized channel gains (h_i):
   0.7092 - 0.4198i   0.1106 - 0.3847i   -0.1777 - 0.1570i   0.2643 - 0.0407i   0.1720 - 0.0571i
```
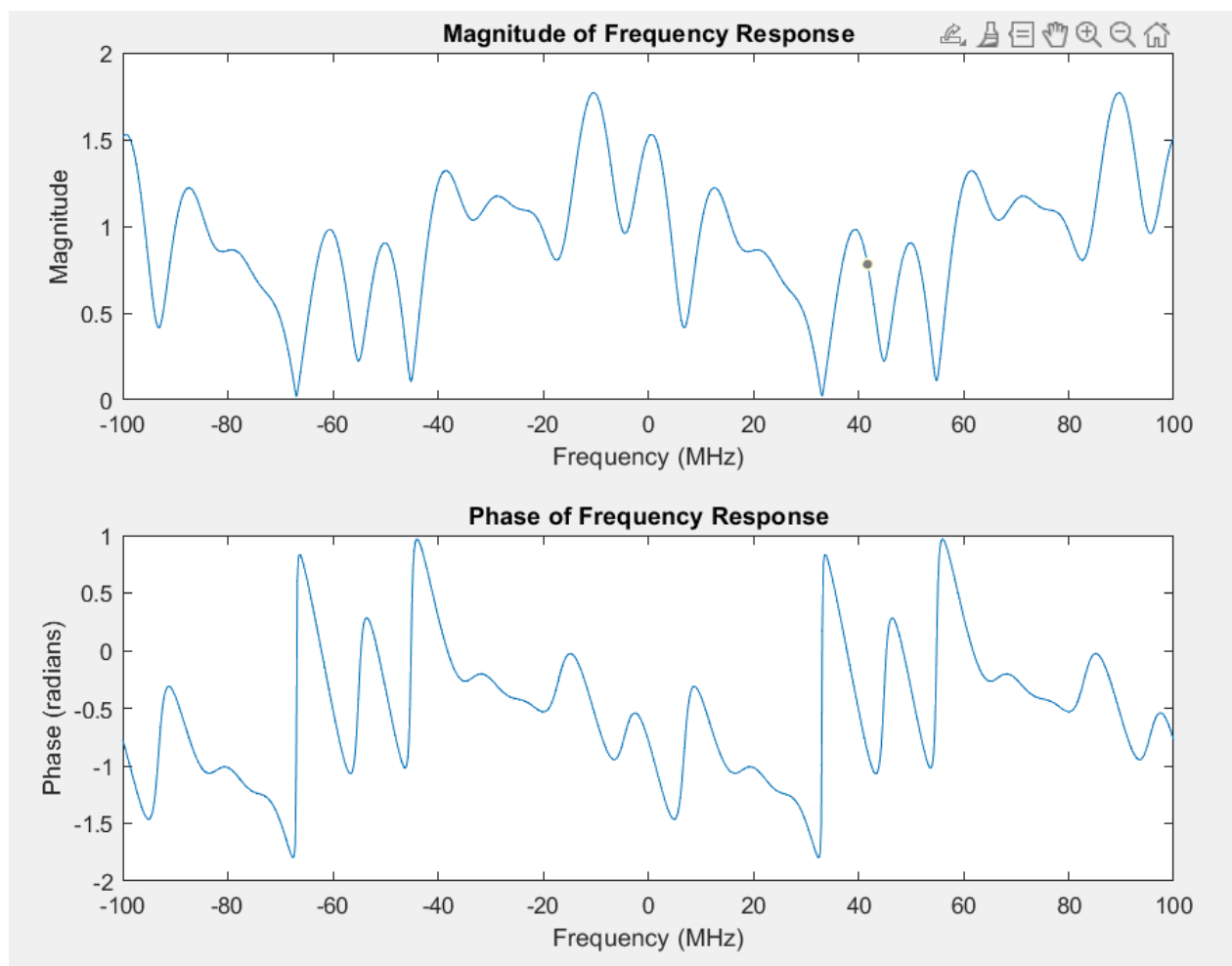
(b)

$$\sum_{i=0}^{4} h_i \, \delta(t - \tau_i)$$

$\updownarrow$ Fourier Transform

$$\sum_{i=0}^{4} h_i \, e^{-j2\pi f \tau_i}$$

(c)

Magnitude of Frequency Response

Phase of Frequency Response

(d)

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Coherence Bandwidth:
    7.8097e+06


Number of subcarriers for flat-fading:
    12
```

3.

$$\tilde{x}_I(t) = LPF\{\tilde{y}(t)\, s_I(t)\}$$

$$= x_I(t)\left(1+\frac{\varepsilon}{2}\right)\cos\left(\frac{\phi}{2}\right) \times \frac{1}{2}$$

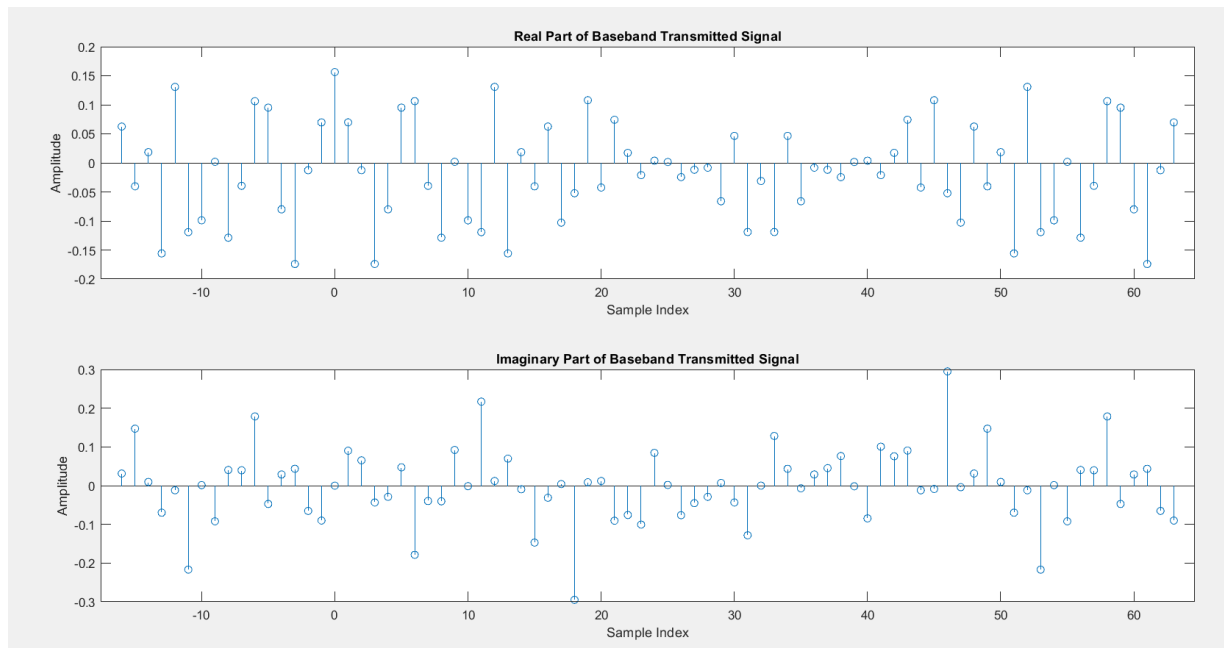$$+ x_Q(t)\left(1-\frac{\varepsilon}{2}\right)\sin\left(\frac{\phi}{2}\right) \times \frac{1}{2}$$

$$\tilde{x}_Q(t) = LPF\{\tilde{y}(t)\, s_Q(t)\}$$

$$= x_Q(t)\left(1-\frac{\varepsilon}{2}\right)\cos\frac{\phi}{2} \times \frac{1}{2}$$

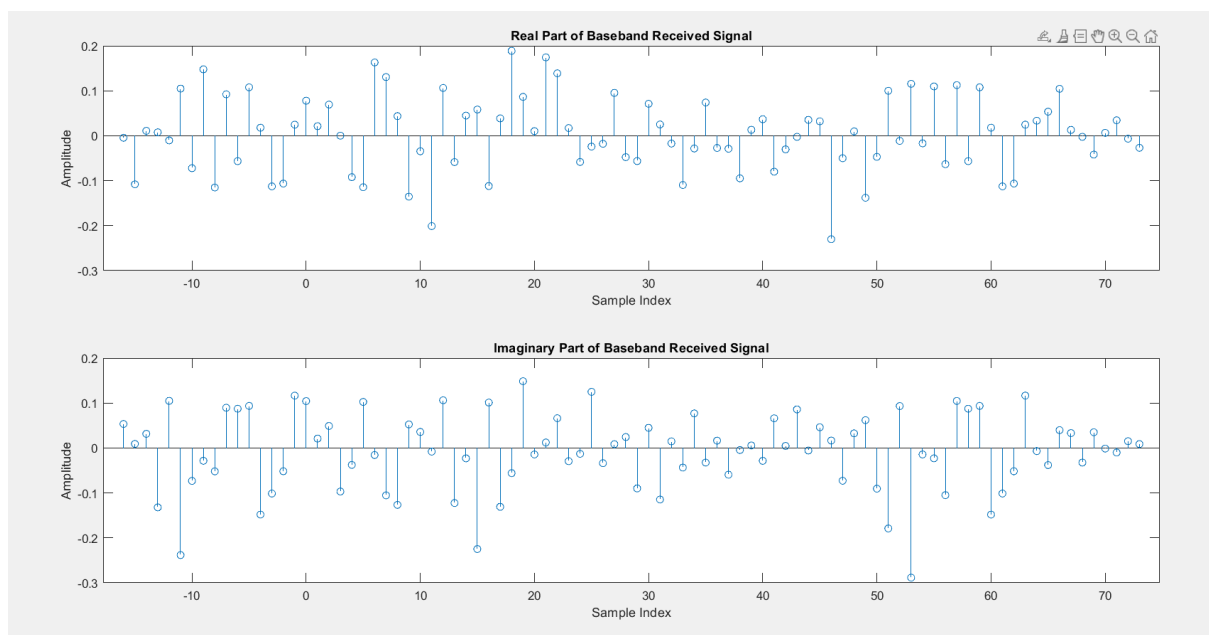$$+ x_I(t)\left(1+\frac{\varepsilon}{2}\right)\sin\frac{\phi}{2} \times \frac{1}{2}$$

4.

(a)

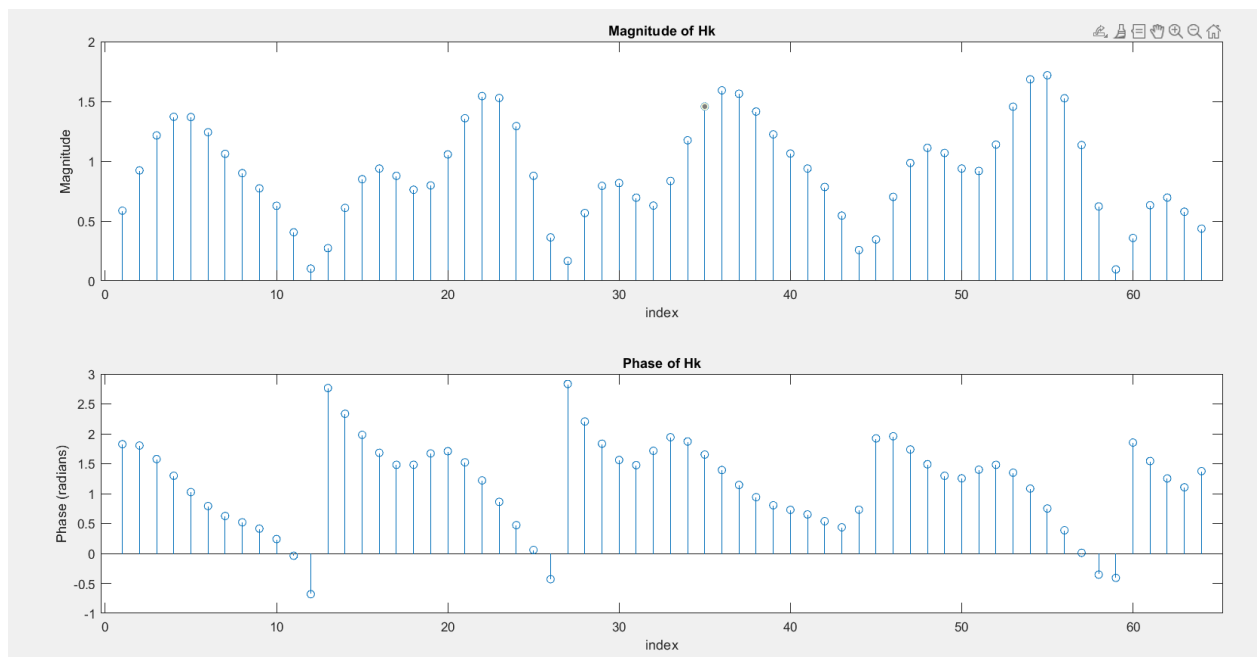because of randomness, the result and the graph below will not be the same, but the property should be the same.

(b)

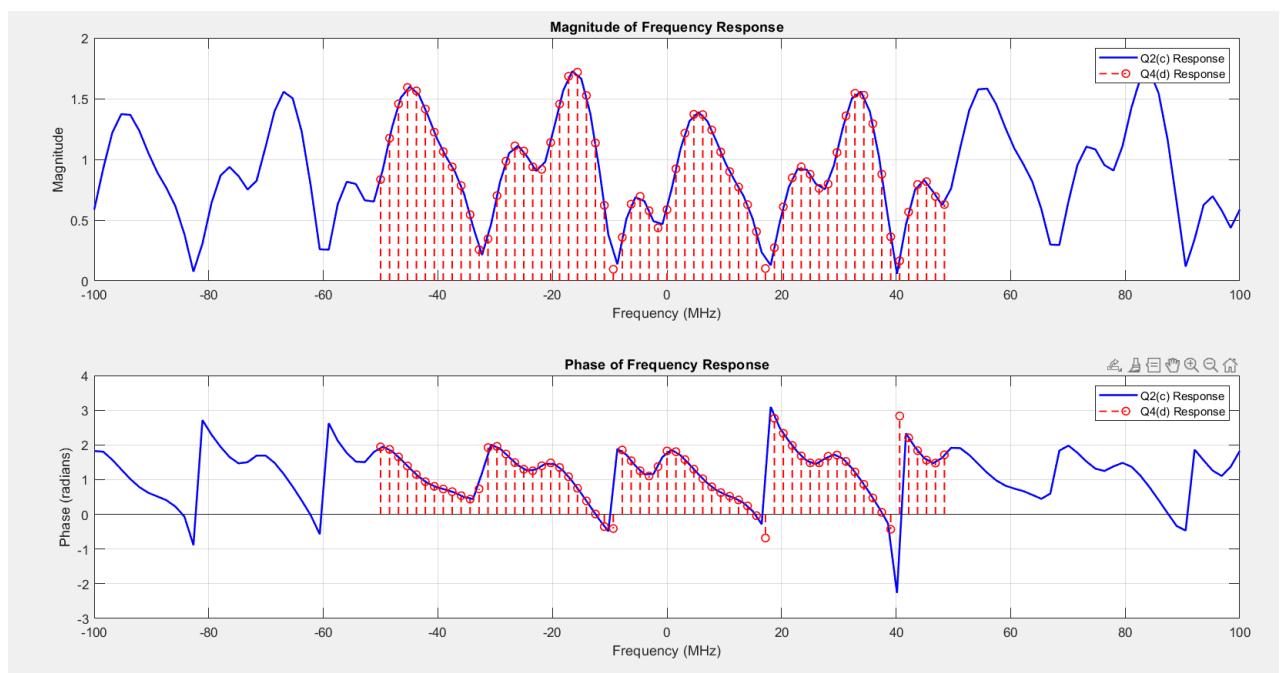
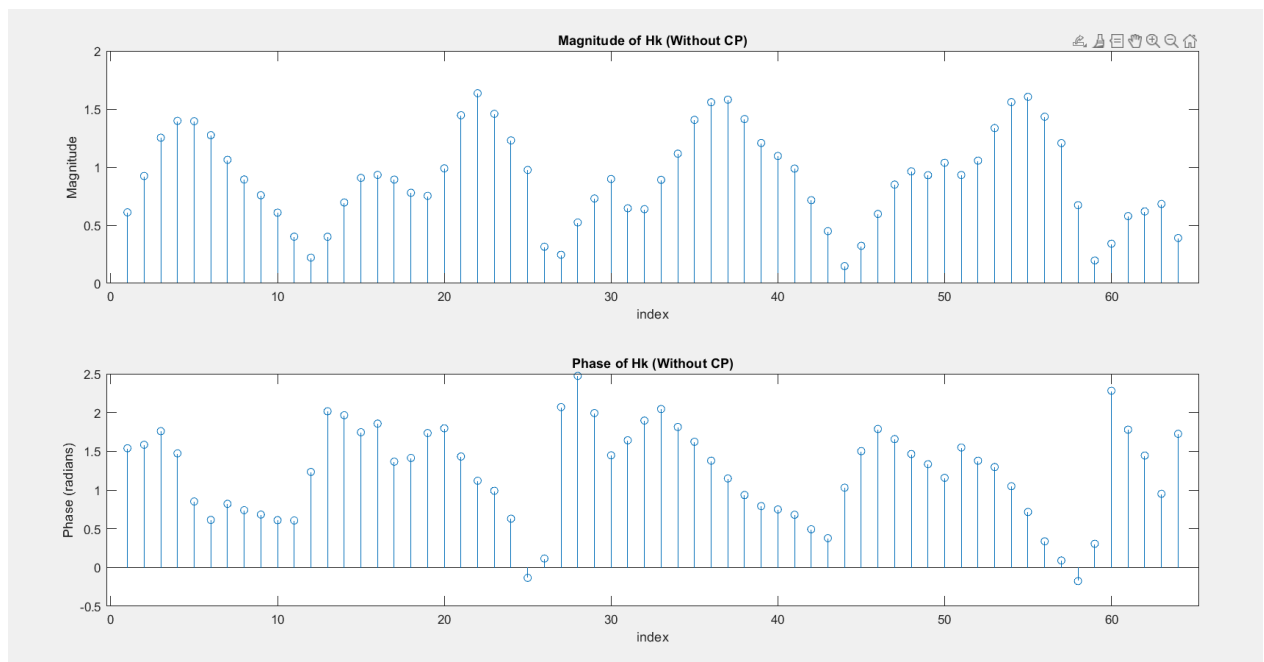**(c)**

(d)

(e)

we can find that Q4(d) is the sampled version of Q2(c)

(f)

(g)

because of ISI, it cannot get proper results.

You can check the graph below:

blue one is Q2(c) red one is Q4(f), and Q4(f) apparently

isn't the sampled version of Q2(c)