

BPSK

Parameter

معادلات

BW

$$B_{\text{BW}} = 2f_b$$

العرض النطاقي

Ts

$$T_s = T_b$$

Hz

Fs

$$F_s = f_b$$

sec

Tb

$$T_b = \frac{1}{f_b}$$

Hz

fb

$$f_b = \frac{1}{T_b}$$

bit/sec

bps

number of bit in BPSK = 1

$$n = 1$$

sample

note

one bit = two ~~sample~~

$$T_s = \frac{1}{f_s}$$



2.1 / / 8/11 : 29/06/21

Note

T_b = bit Duration $\rightarrow$ bit/sec

F_b = bit rate $\rightarrow$ bps

T_s = Symbol Duration $\rightarrow$ sec

F_{cs} = symbol rate $\rightarrow$ Hz

BW = transmission bandwidth $\rightarrow$ Hz

If the input bit rate to BPSK is 20Mbps
find the Symbol rate?

$$F_b = 20 \text{ M bps}$$

$$F_{cs} = ?$$

$$F_s = F_b$$

$$F_s = 20 \text{ M Hz}$$

Q 18 / if input bit rate to BPSK is 10 Mbps

Find the BW?

$$F_b = 10 \text{ Mbps}$$

BW = ?

$$B \leq 2 F_b$$

$$BW = 2 \times 10 \text{ M}$$

$$B = 20 \text{ MHz}$$

Q 22 / For a 100 Mbps digital input to a BPSK system. Calculate bit Duration T_b , symbol Duration T_s , Symbol rate f_s

$$F_b = 100 \text{ M} \quad F_s = ? \quad T_s = ? \quad T_b = ?$$

$$F_s = F_b$$

$$F_s = 100 \text{ MHz}$$

$$T_s = \frac{1}{100 \text{ M}} \text{ sec}$$

$$T_s = T_b$$

$$T_b = \frac{1}{F_b}$$

$$T_b = \frac{1}{100 \text{ M}} \text{ bit/sec}$$

$$T_s = \frac{1}{F_s}$$

QPSK

Quadrature Phase Shift Keying

Parameters

1- BW

$$BW \approx F_b$$

Hz

2- T_s

$$T_s = 2 T_b$$

sec

3- F_s

$$F_s = \frac{F_b}{2}$$

Hz

4- T_b

$$T_b = \frac{1}{F_b}$$

bit/sec

5- F_b

$$F_b = \frac{1}{T_b}$$

bps

note

* number of bit in QPSK = 2 bit

* two bit = 1 Symbol

Ex 13 / التاريخ : 29/09/2021
 if the input bit rate to QPSK is 10 M bps
 find the symbol rate F_s
 $F_{cs} = ?$ $F_b = 10 \text{ M bps}$

$$F_s = \frac{F_b}{2} = \frac{10 \text{ M}}{2} = 5 \text{ M Hz}$$

Ex 14
 if the input bit rate to QPSK
 is 10 M bps find BW?

$$BW = ? \quad F_b = 10 \text{ Mbps}$$

$$BW = F_b$$

$$BW = 10 \text{ M Hz}$$

Ex 23 / For 250 Mbps digital input to QPSK
 system calculate Bit duration,
 symbol duration, Symbol rate

$$F_b = 250 \text{ M} \quad T_b = ?, F_s = ?, T_s = ?$$

$$T_s = 2 T_b \quad T_s = 500 \text{ ns}$$

$$T_s = 2 (250) \text{ ns}$$

التاريخ / / ٢٠١١

الموضوع :

$$T_b = \frac{1}{F_b} = \frac{1}{250 \text{ M}} \text{ bit/sec}$$

$$T_s = 2 T_b$$

$$T_s = \frac{2}{250 \times 10^6} = \frac{1}{125 \times 10^6} \text{ sec}$$

$$F_s = \frac{F_b}{2} = \frac{250 \text{ M}}{2} = 125 \text{ M Hz}$$

التاريخ

M ary

الرمز

Parameter

معدون

الرمز

BW

$$BW = \frac{2F_b}{N}$$

Hz

TS

$$TS = N T_b$$

sec

FS

$$F_s = \frac{F_b}{N}$$

Hz

Tb

$$T_b = \frac{1}{F_b}$$

bit/sec

Fb

$$F_b = \frac{1}{T_b}$$

bps

M

$$M = 2^N$$

ary

note

bit/sec n

$$n = \frac{\log M}{\log 2}$$

M هو عدد البتات في السؤال
Fb و BW هما

$$n = \frac{2 F_b}{BW}$$

$$T_s = \frac{1}{F_s}$$

LS - m-ary phase shift

ex/ 8.3.2 } $F_b = 1 \text{ Mbps}$
 $F_{cs} = ?$ $BW = ?$

1) BPSK 2) QPSK 3) M-ary

1. BPSK

$BW = ?$ $F_{cs} = ?$

$T_b = \frac{1}{F_b} = \frac{1}{1 \times 10^6} \text{ bit/sec}$

$T_s = T_b = \frac{1}{1 \times 10^6} \text{ sec}$

$F_{cs} = F_b = 1 \times 10^6 \text{ Hz}$

$BW = 2 F_b = 2 \times 10^6$

$BW = 2 \times 10^6 \text{ Hz}$

2) QPSK

$$T_b = \frac{1}{f_b} = \frac{1}{1 \times 10^6} \text{ bit/sec}$$

$$T_s = 2 T_b$$

$$T_s = 2 \times \frac{1}{1 \times 10^6} = \frac{2}{1 \times 10^6} \text{ sec}$$

$$f_{GL} = \frac{f_b}{2} = \frac{1 \times 10^6}{2} = 0.5 \times 10^6 \text{ Hz}$$

$$BW = f_b$$

$$= 1 \times 10^6 \text{ Hz}$$

3- m-ary 16-ary

$$M=16$$

$$M=2^n$$

$$16=2^n$$

$$\log_{10} 16 = n \log_{10} 2$$

$$n = \frac{\log_{10} 16}{\log_{10} 2} = 4 \text{ bit}$$

$$T_b = \frac{1}{F_b} = \frac{1}{1 \times 10^6} \text{ bit/sec}$$

$$T_s = N \cdot T_b = 4 \times \frac{1}{1 \times 10^6}$$

$$T_s = 4 \times 10^{-6} \text{ sec} \Rightarrow T_s = 4 \mu\text{sec}$$

$$f(s) = \frac{F_b}{N} = \frac{1 \times 10^6}{4} = \frac{1000 \times 10^3}{4}$$

$$f(s) = 250 \text{ KHz}$$

$$BW = \frac{2 F_b}{N} = \frac{2 \times 1 \times 10^6}{4} = 0.5 \times 10^6$$

Ex 2.5.3

$$f_b = 90 \text{ Mbps}$$

$$B_w = 20 \text{ MHz}$$

$$N = ?$$

$$B_w = \frac{2 f_b}{N}$$

$$20 \times 10^6 = \frac{2 \times 90 \times 10^6}{N}$$

$$N = \frac{2 \times 90 \times 10^6}{20 \times 10^6}$$

$$N = \frac{18}{2} = 9 \text{ bit}$$

$$M = 2^N$$

$$M = 2^9$$

$$M = 512$$

This shows that 512-ary PSK can transmit the 90 MHz signal in the bandwidth of 20 MHz

$$T_s = \frac{1}{f_s}$$

قوانين
معدلات نقل البيانات : BPSK , QPSK , M-ary

Parameter BPSK QPSK M-ary

BW $2F_b$ F_b $\frac{2F_b}{N}$

~~TS~~ T_b $2T_b$ $N T_b$

~~FS~~ F_b $\frac{F_b}{2}$ $\frac{F_b}{N}$

~~Tb~~ $\frac{1}{F_b}$ $\frac{1}{F_b}$ $\frac{1}{F_b}$

~~Fb~~ $\frac{1}{T_b}$ $\frac{1}{T_b}$ $\frac{1}{T_b}$

note

BW = bandwidth transmission Hz

TS = symbol duration sec

FS = symbol rate Hz

Tb = bit duration bit/sec

Fb = bit rate bps

؟ M-ary ، QPSK ، BPSK إلى أي شيء

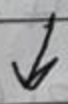
Parameter	BPSK	QPSK	M-ary
Symbol	2	4	N
number of bit	1	2	N
change of phase	180°	90°	45°

Transmitted waveform equation for this M-ary PSK

$$s(t) = \sqrt{2} p_s \cos(2\pi f_c t + \phi_m)$$

$$m = 1, 2, 3 \longrightarrow M$$

$$\phi_m = (2m + 1) \frac{\pi}{M}$$



Symbol phase angle