

210202G

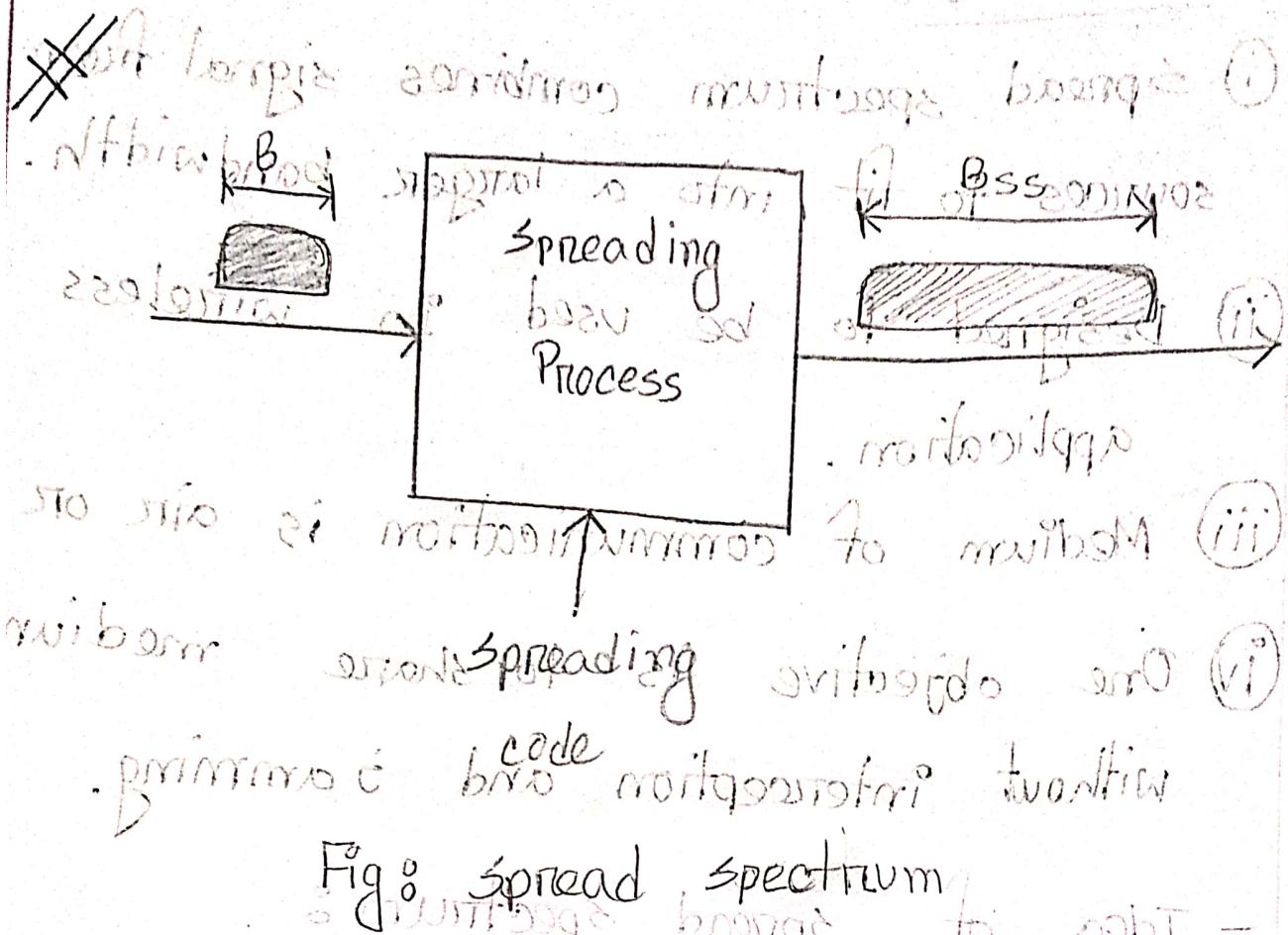
Spread Spectrum

- Properties :-

- i) Spread spectrum combines signal from several sources to fit into a larger bandwidth.
- ii) Designed to be used in wireless application.
- iii) Medium of communication is air or vacuum.
- iv) One objective is to share medium without interception and jamming.

- Idea of spread spectrum :-

- i) Add redundancy
- ii) Spreads original spectrum by B_{ss} .
- iii) If the required bandwidth for each station is B , spread spectrum expands it to B_{ss} such that $B_{ss} \gg B$.
- iv) Source is wrapped in protective envelope.



Here, The original message with bandwidth B_m and spreading code bandwidth B_s has one more input called spreading code. This bandwidth, B_s , and the spreading code has no relation; just we need to increase the original data signal.

After add spreading code we'll get the B_{ss}.

Hence, B_{ss} >> B.

B_{ss} is the increase bandwidth. And it allow to the message transfer sequentially to the destination without interception.

- Techniques to spread bandwidth :-

i) Frequency Hopping Spread Spectrum (FHSS)

ii) Direct Sequence Spread Spectrum (DSSS)

- FHSS: Frequency Hopping Spread Spectrum

► Use different carrier frequencies.

► Bandwidth after spreading is

$$B_{FHSS} \gg B_{bit/band}$$

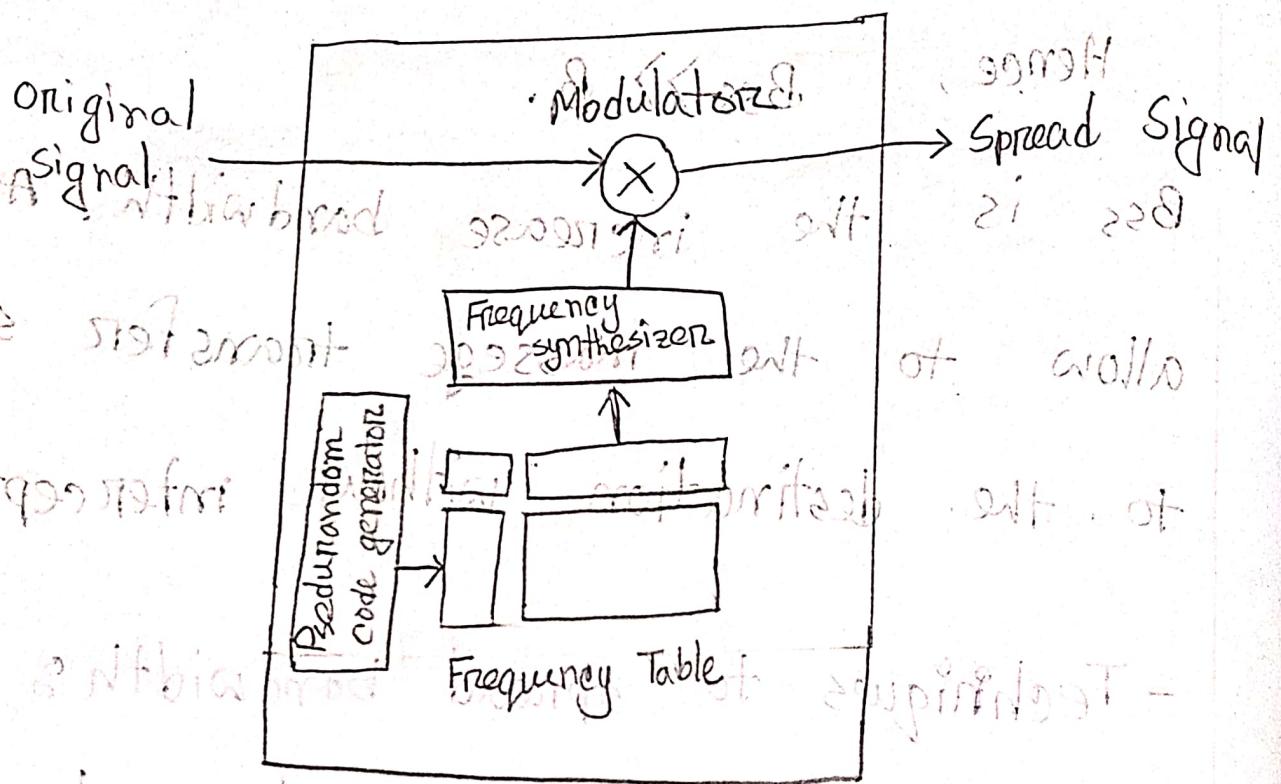


Fig : Frequency Hopping Spread Spectrum (i)

Here,

The original message has to be converted into modulated message.

In modulation, we combine original message

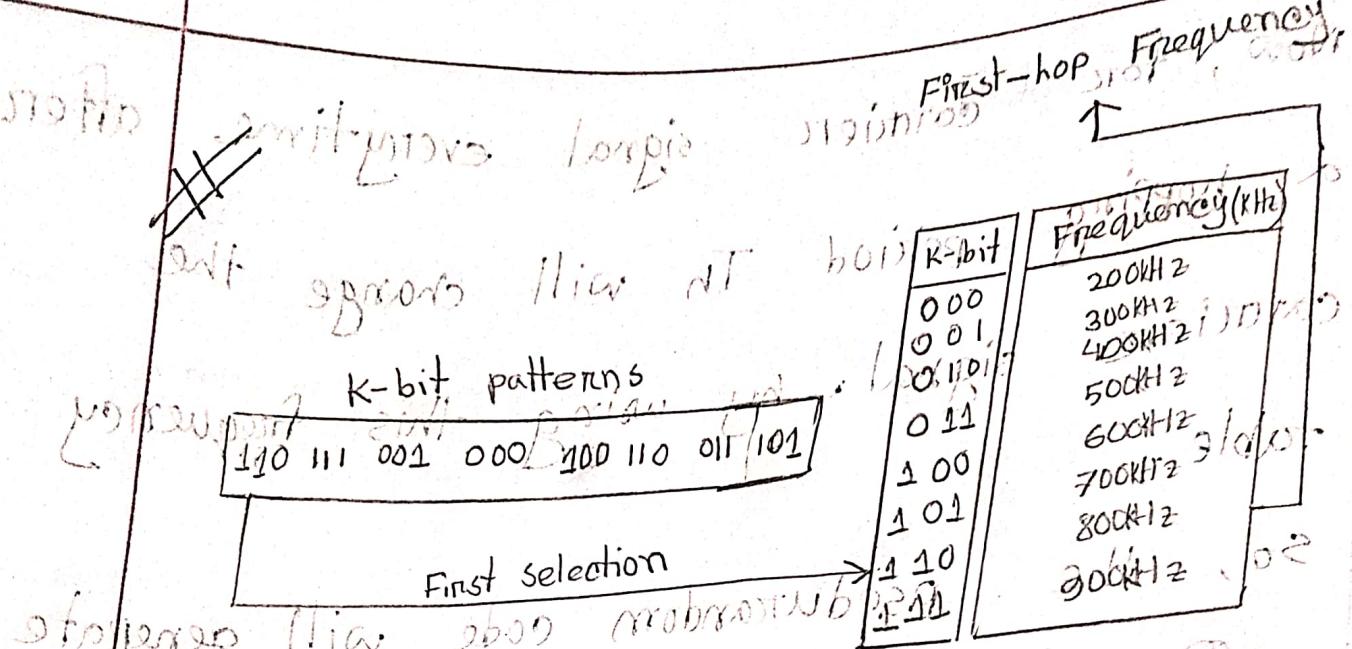
with the carrier signal. And we get

the modulated signal.

Now, for carrier signal every time after a hopping period T_h will change the carrier signal by using this frequency table.

so, the pseudorandom code will generate different k -bit pattern for every time then from the frequency table different frequency will selected and it used the frequency synthesizer. This signal will modulated. So, that we'll get the signal with the bandwidth Δf .

• btsloban Niw stob at diff TA, Δf
• std 008 Pcsport misipos at diff TA
• btsloban Niw stob at diff TA

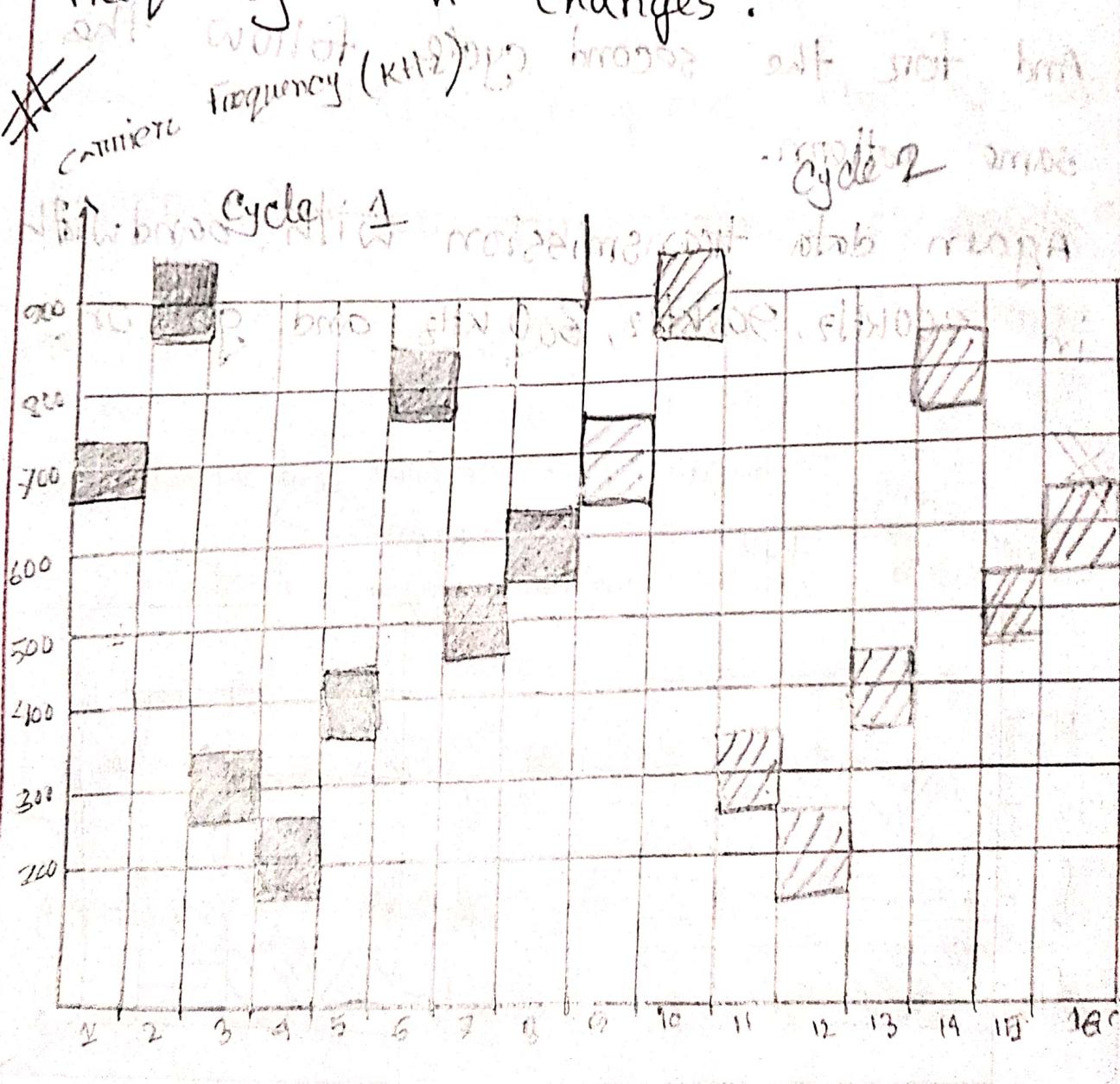


first-hop frequency selection in FHSS

Now, if bits b₀ to b₃ are transmitted sequentially, consider that, k-bit patterns are generated by pseudorandom generator. For example, at time t₁, the k-bit is 110, so frequency is 800kHz.

So, At time t₁ data will be modulated with the carrier frequency 800 kHz. At time t₂ data will be modulated with 900 kHz.

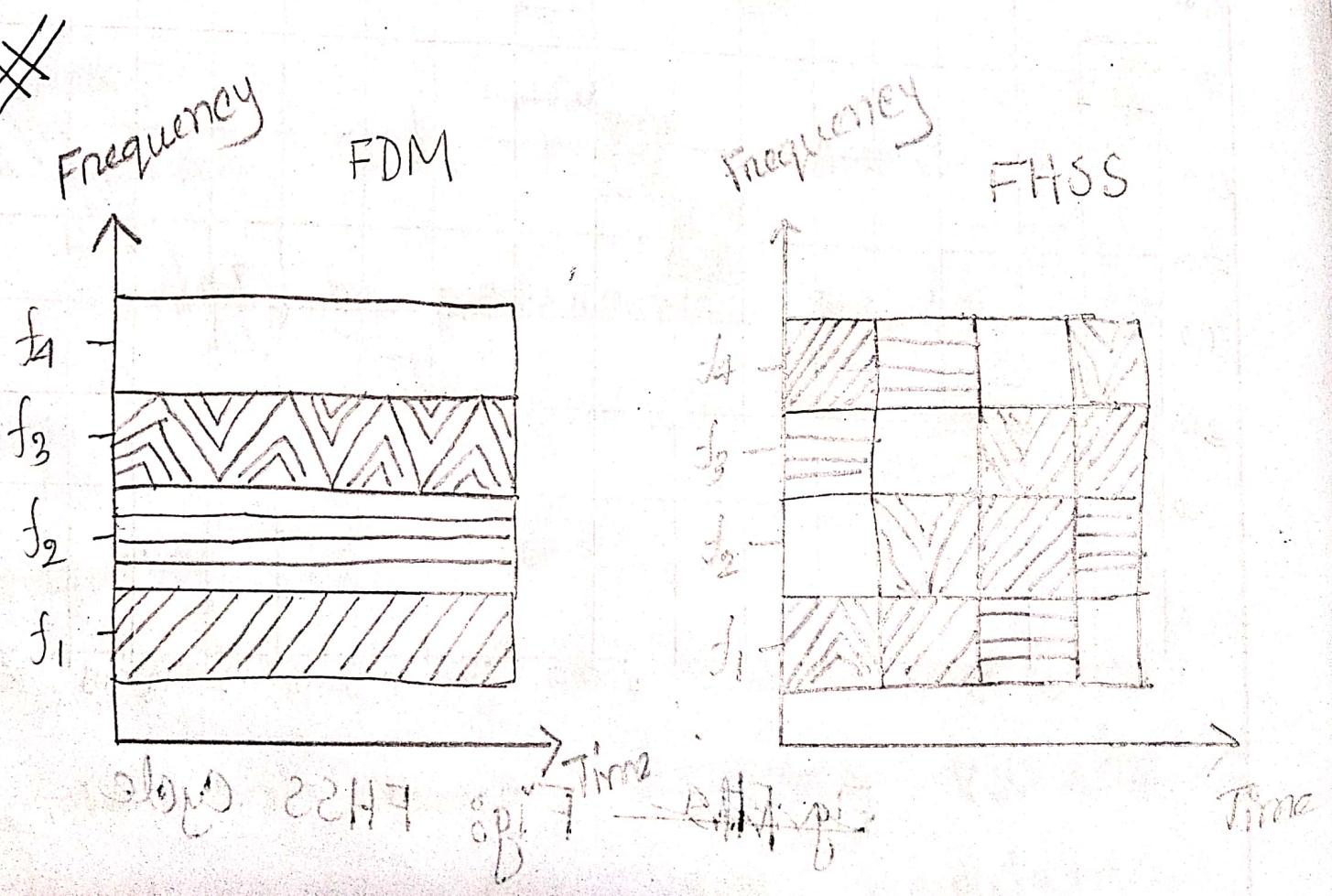
And lastly the which will modulated with the carrier frequency 700 kHz.
 Thus, every time for every cycle the carrier frequency will changes.



~~Eight~~ Fig 9: FHSS Cycle

Here, In first time data will be in 800 kHz frequency. For second, 900 kHz frequency. Then third period it will be 300 kHz. It'll continue upto the eighth period. And for the second cycle follow the same pattern.

Again data transmission with bandwidth in 800 kHz, 900 kHz, 300 kHz and go on.



In FDM (Frequency-Division Multiplexing), the entire bandwidth divided into 4 (four) channels. (f_1, f_2, f_3, f_4). There are all continuously use the same frequency for each channel.

Now, in FHSS (Frequency Hopping Spread spectrum), for first time f_1 , modulated this  low frequency, then time two it modulated with  frequency, after then time three  and atlast time four .

[FDM remain constant but FHSS continuously changes.]

Same thing repeat for other f_2, f_3 and f_4 carrier frequency.

Direct Sequence Spread Spectrum (DSSS)

- Expands the bandwidth of the original signal.
- Each data bit is replaced with 11 bits using spreading code.

~~Brings off component) 22 H7. we can~~

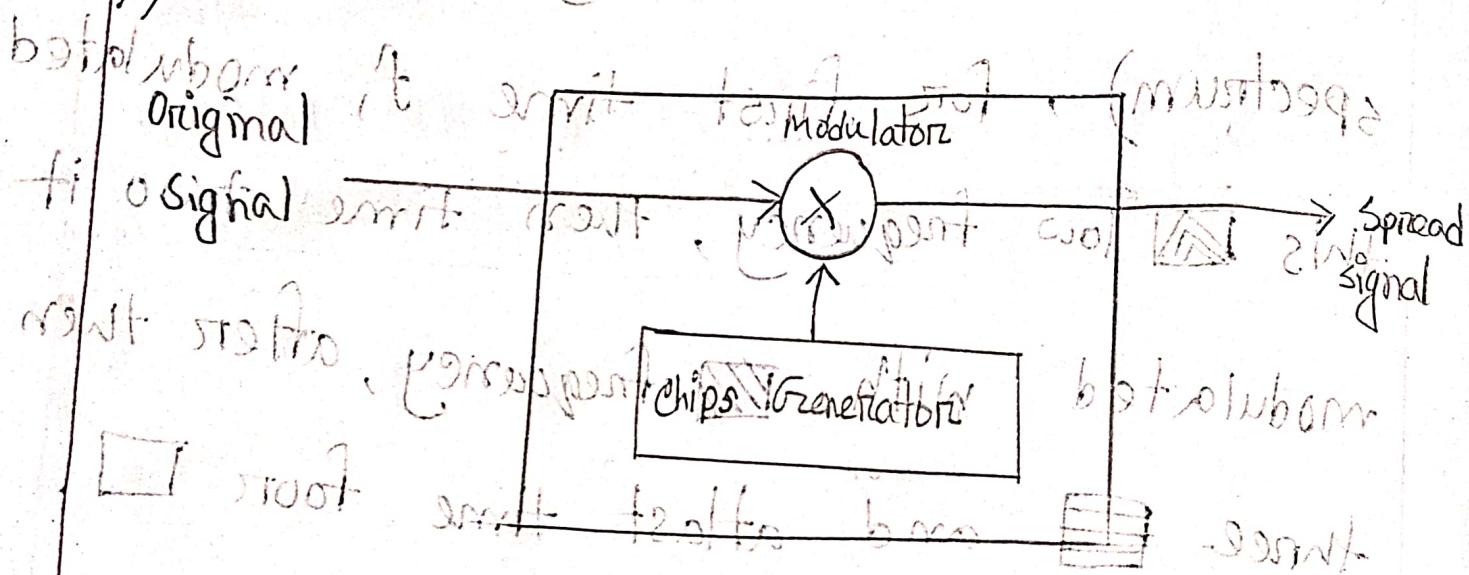


Fig: Direct sequence spread spectrum (DSSS)

Here, To the original signal will applied the chips generator, then the original signal will be modulated we will get the spread signal.

This spread signal (signal travel through the network). Due to noise, other signals

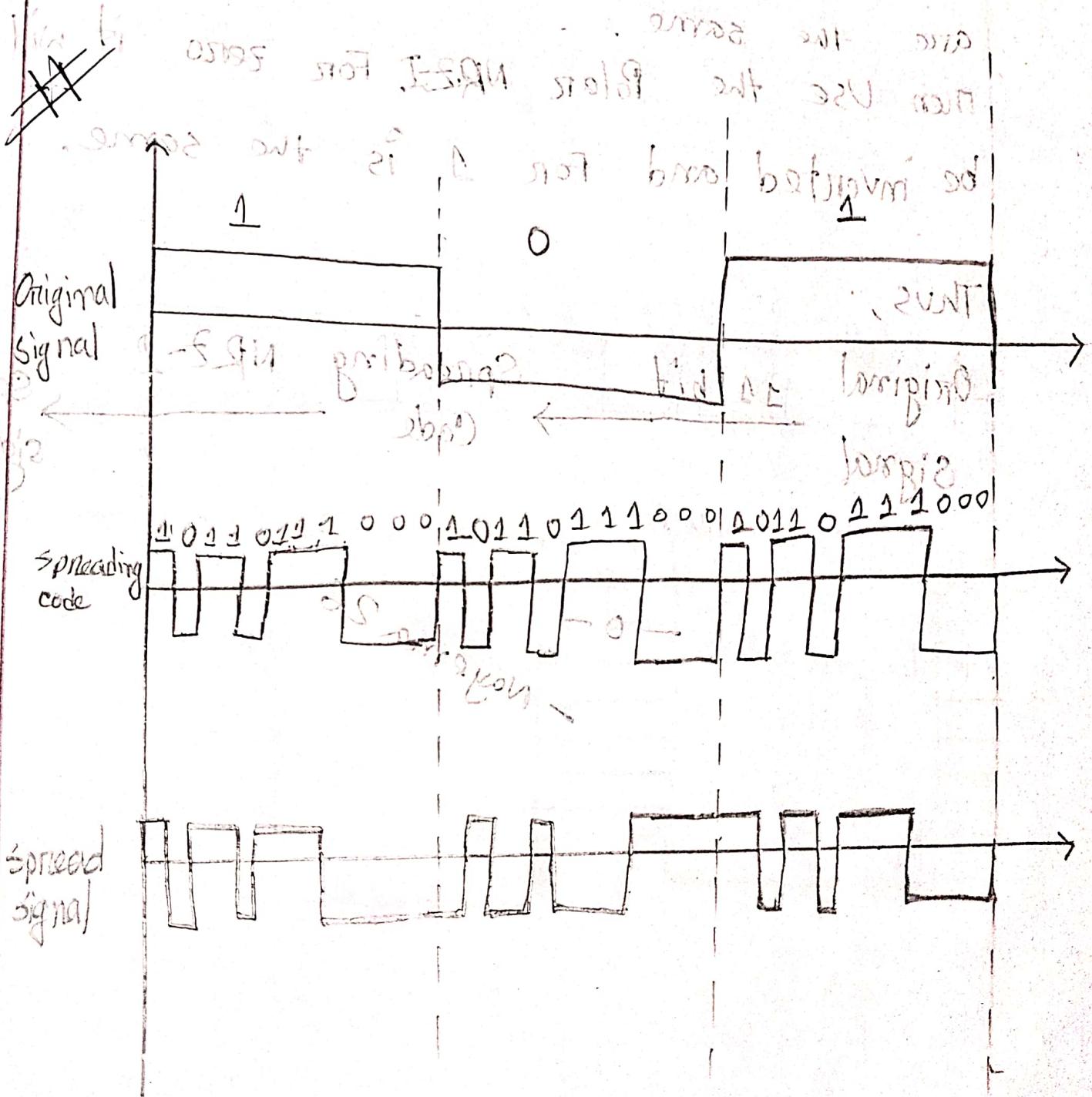
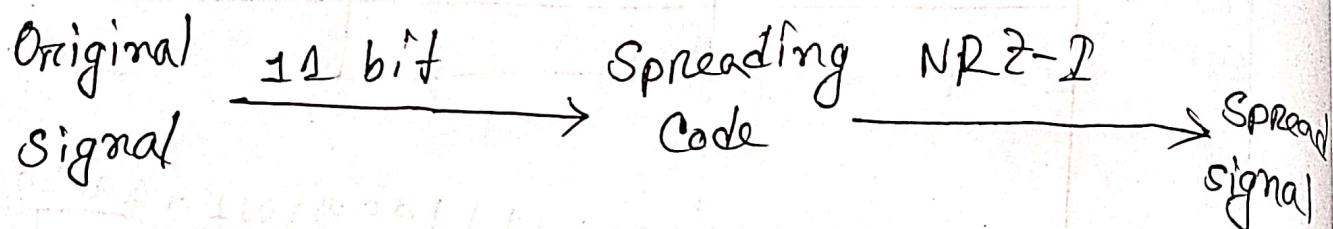


Fig: DSSS Example

Here,
 The 11 bit (10110111100). This is fixed
 spread code. Now for the 1 and 0 (zero) code
 are the same.

Then use the Polar NRZ-I. For zero it will
 be inverted and for 1 is the same.

Thus,



-0-
 - Nayernia 26