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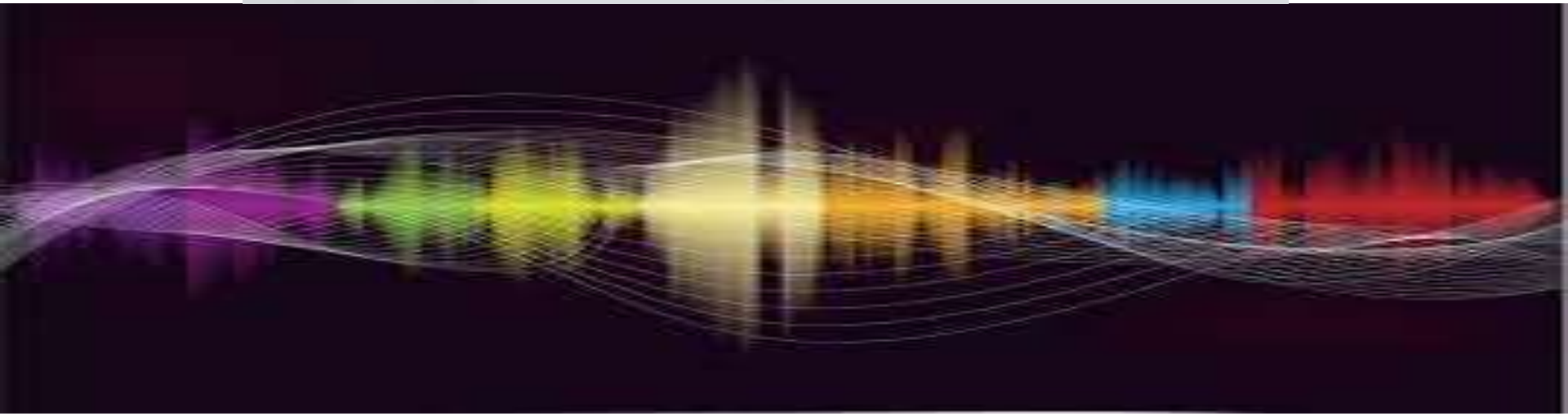
Frequency-hopping spread spectrum



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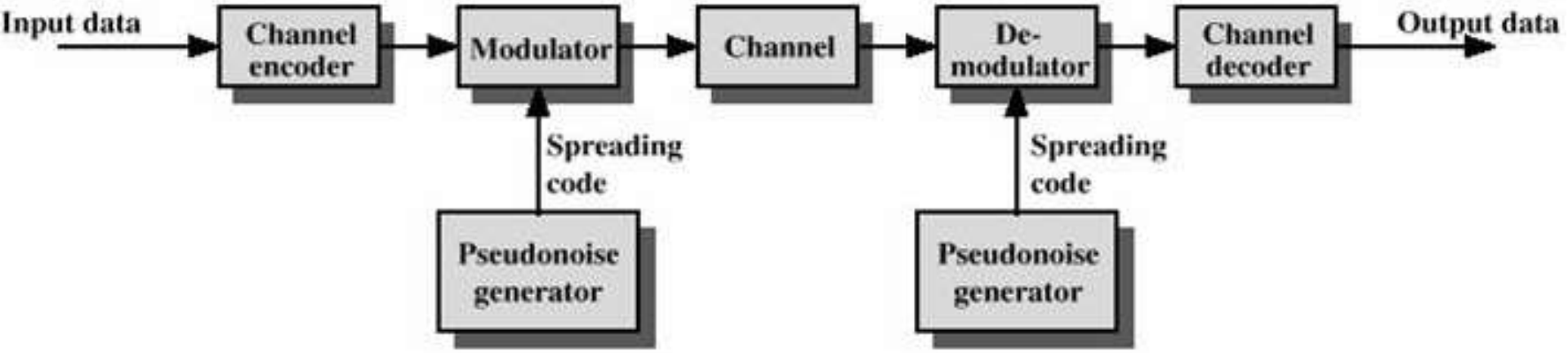
C016

Introduction

- Frequency Hopping Spread Spectrum (FHSS) is a method of transmitting radio signals by rapidly switching a carrier among many frequency channels, using a pseudorandom sequence known to both transmitter and receiver.
- The data signal is modulated with a narrowband carrier signal that "hops" in a random but predictable sequence from frequency to frequency as a function of time over a wide band of frequencies.
- It is used as a multiple access method in the frequency-hopping code division multiple access (FH-CDMA) scheme.

FHSS Block Diagram



Pseudo Noise Generator

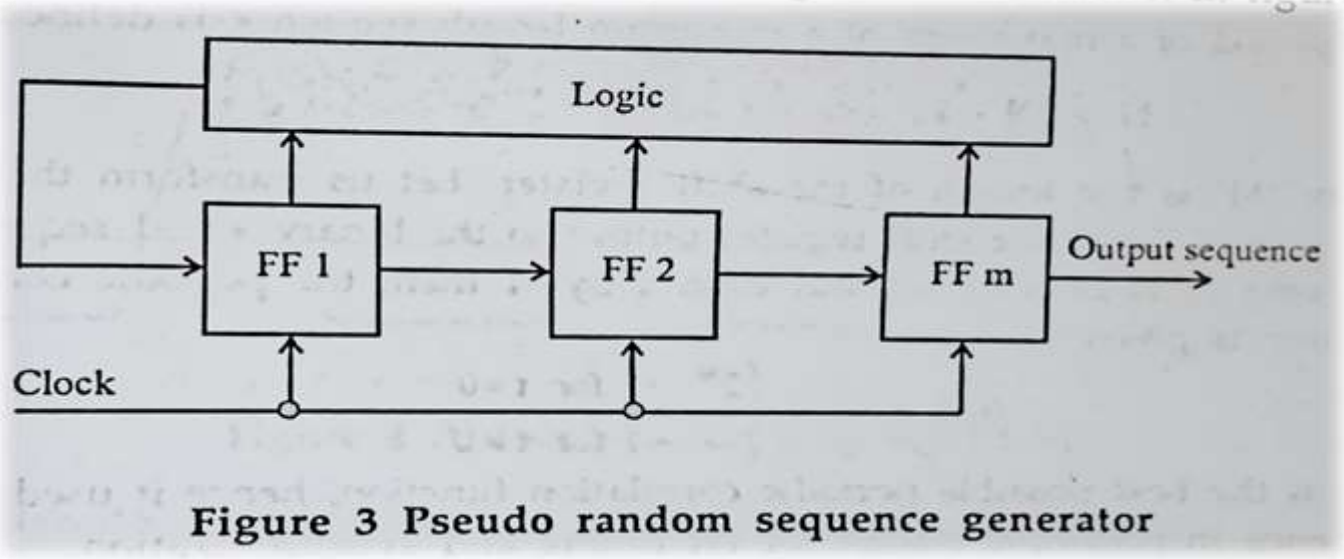


Figure 3 Pseudo random sequence generator

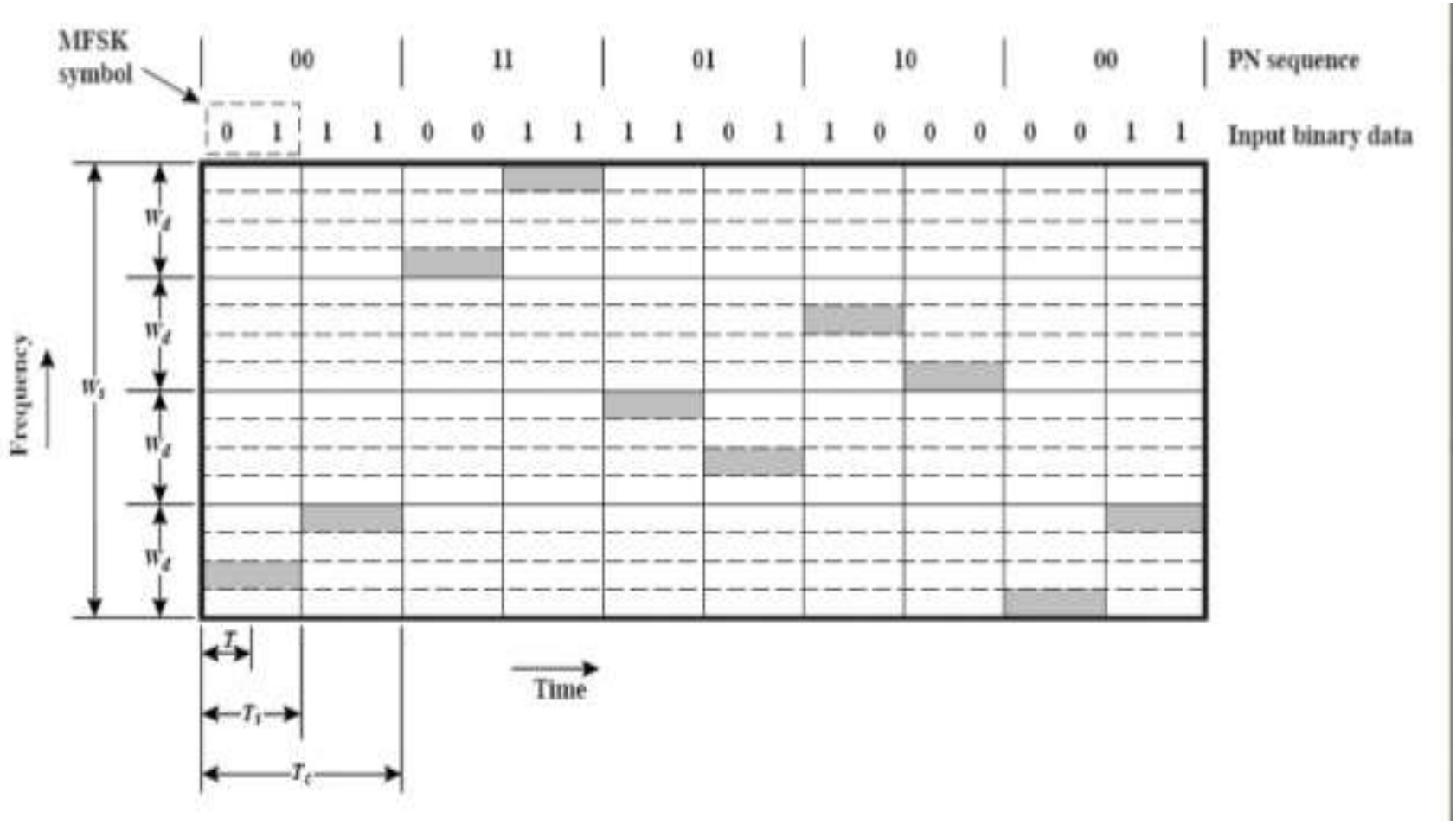
Used to spread the bandwidth of the modulated signal to the larger transmission bandwidth

Types of FHSS

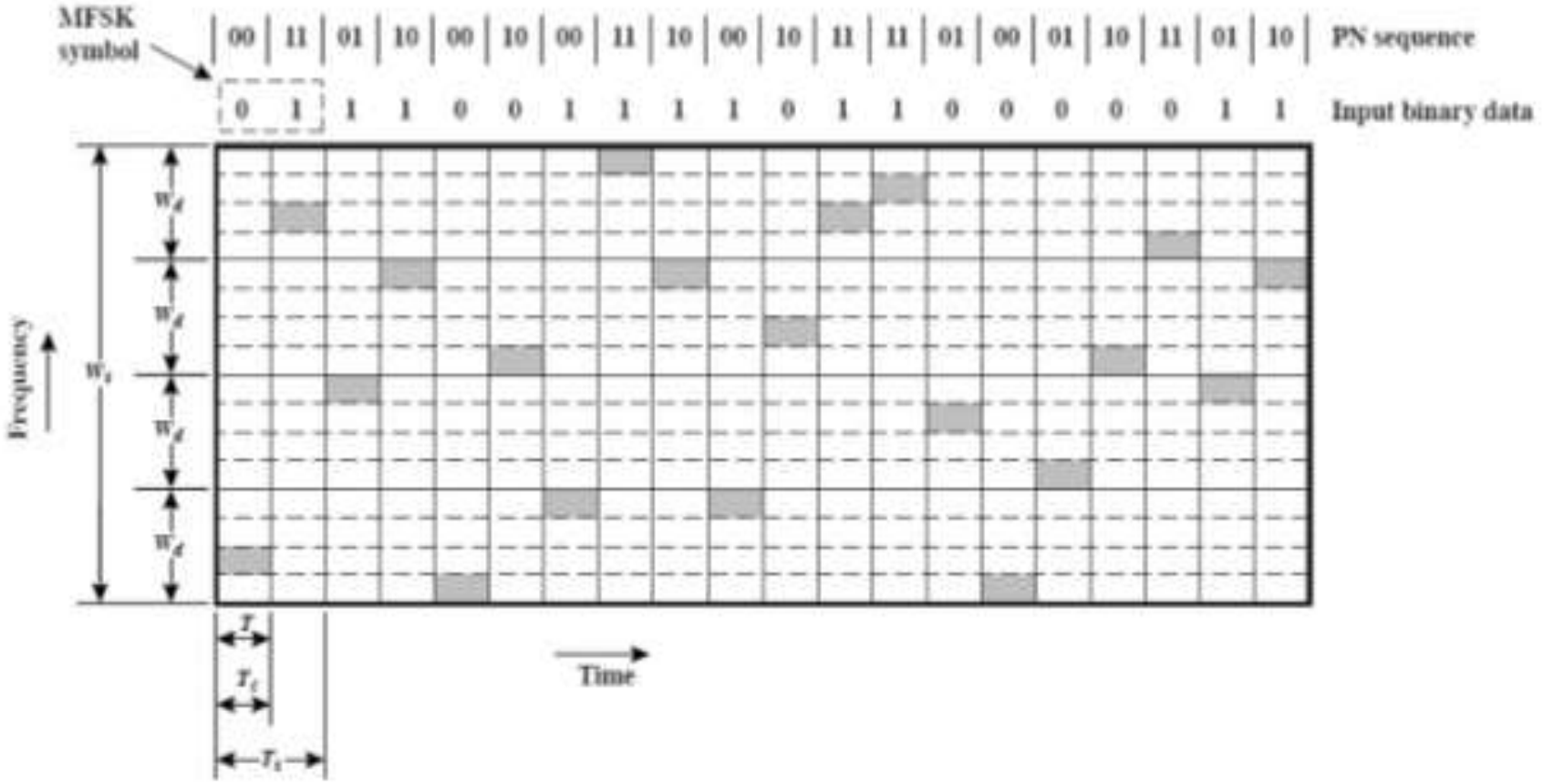
- THERE ARE TWO TYPES OF FREQUENCY HOPPING:

1. SLOW FREQUENCY HOPPING SPREAD SPECTRUM
2. FAST FREQUENCY HOPPING SPREAD SPECTRUM

Slow FHSS


MFSK symbol
00
11
01
10
00
PN sequence
0 1 1 1 0 0 1 1 1 1 0 1 1 0 0 0 0 0 1 1
Input binary data
W_d
W_d
W_d
W_d
W_s
Frequency
T_c
T_s
T_c
Time

Fast FHSS


MFSK symbol
00 11 01 10 00 10 00 11 10 00 10 11 11 01 00 01 10 11 01 10
PN sequence
0 1 1 1 0 0 1 1 1 1 0 1 1 0 0 0 0 0 1 1
Input binary data
Frequency
Time

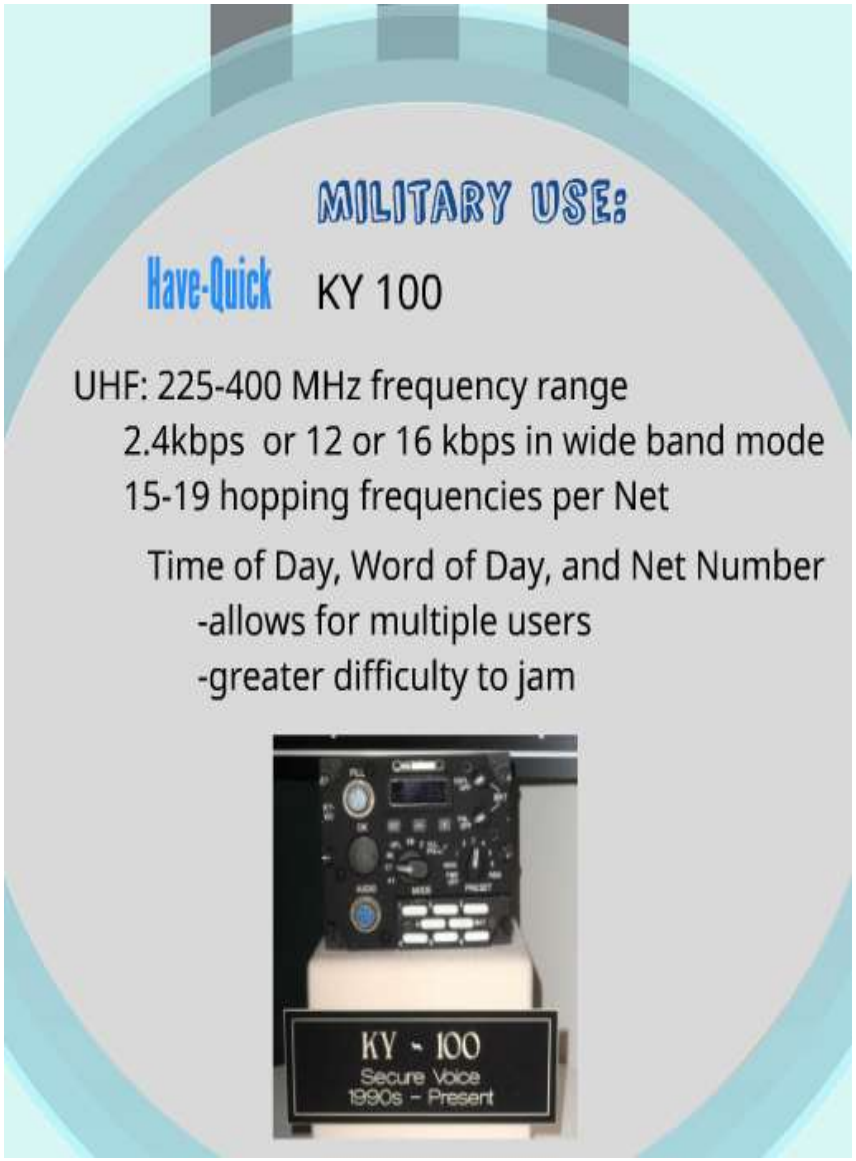
Uses of FSHH

- Military use
- Bluetooth
- Walkie-Talkies
- Other radios

Military Use

- Spread-spectrum signals are highly resistant to deliberate jamming, unless the adversary has knowledge of the spreading characteristics.
- Military radios use cryptographic techniques to generate the channel sequence under the control of a secret Transmission Security Key (TRANSEC) that the sender and receiver share in advance.
- By itself, frequency hopping provides only limited protection against eavesdropping and jamming.

- Most modern military frequency hopping radios also employ separate encryption devices such as the KY-100.



Other radios

Other radios:

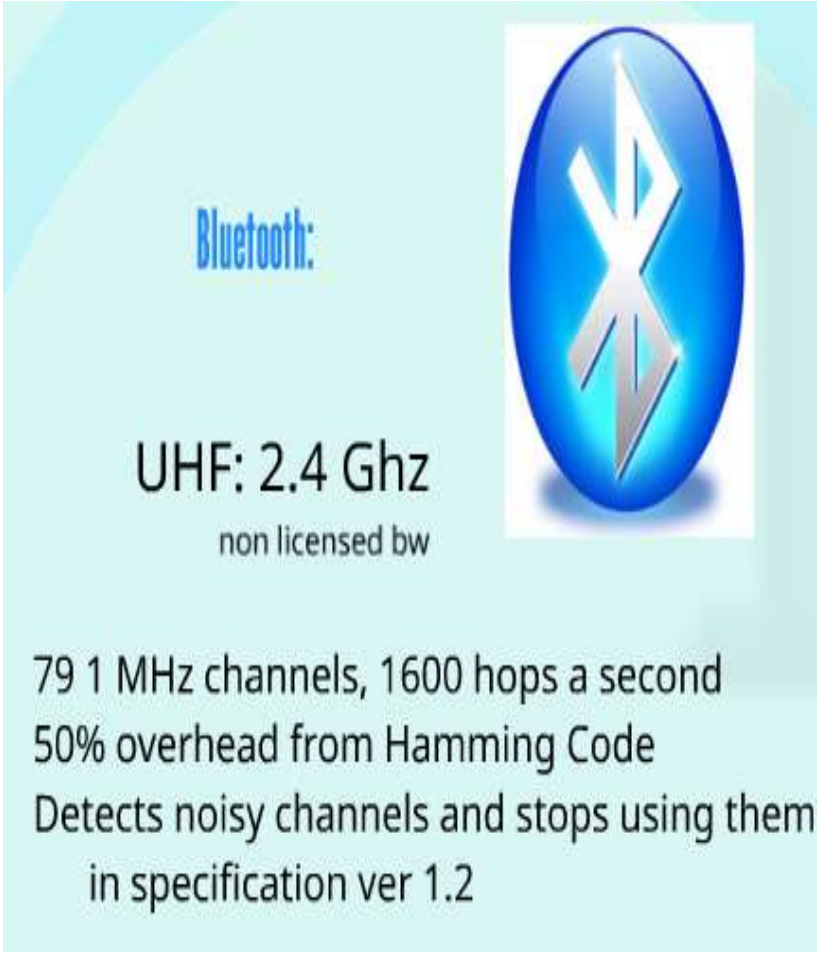
SINCGARS
(Single Channel Ground and Airborne Radio System)

VHF FM band, from 30 to 87.975 MHz
-2.5k channels totaling 2320 channels

111 hops per second

Bluetooth

- Adaptive Frequency-hopping spread spectrum (AFH) (as used in Bluetooth) improves resistance to radio frequency interference by avoiding crowded frequencies in the hopping sequence. This sort of adaptive transmission is easier to implement with FHSS.



Walkie-Talkies

- Some walkie-talkies that employ frequency-hopping spread spectrum technology have been developed for unlicensed use on the 900 MHz band. Several such radios are marketed under the name eXtreme Radio Service (eXRS).

- Motorola has deployed a business-banded, license-free digital radio that uses FHSS technology: the DTR series, models 410, 550 and 650.

Thank you.

Any ?