DSSS (Direct Sequence Spread Spectrum)

DSSS is a transmission technology used in wireless communication. This method involves spreading the signal over a larger bandwidth than what is required for simple transmission. The original data signal is combined with a higher rate bit sequence, also known as a chipping code, to increase the signal's bandwidth.

Working

In DSSS, the transmitter takes the original data signal and multiplies it with a chipping code, resulting in a wider frequency spectrum signal. This chipping code, or pseudorandom code, is a sequence of 0s and 1s at a much higher frequency than the original signal. The receiver, using the same chipping code, can then de-spread the spread signal and retrieve the original data.

This means that even if a part of the signal is affected during transmission, the receiver can still recover the original data, thereby reducing the potential for data loss or corruption. This process of spreading and despreading is what provides DSSS with its resistance to interference and ability to maintain signal integrity.

Benefits

- Increased Signal Integrity: DSSS enhances signal integrity by spreading the signal over a broad spectrum, reducing the impact of interference and noise.
- Improved Security: Since the signal is spread across a wide frequency band, it's harder for unauthorized users to intercept or eavesdrop.
- Co-existence: Multiple DSSS systems can coexist in the same frequency band without interfering with each other due to unique chipping codes.
- High Speed: Despite the increased bandwidth, DSSS can accommodate high-speed data transmission.

DSSS applications

Wi-Fi Networks: DSSS is used in Wi-Fi networks to allow multiple devices to communicate simultaneously without mutual interference. It's especially prevalent in 802.11b Wi-Fi standard.

Global Positioning System (GPS): GPS uses DSSS to ensure signal integrity and accuracy of location data.

Cellular Networks: DSSS is employed in 3G, 4G, and 5G cellular networks to improve signal quality and reduce errors.

FHSS Frequency Hopping Spread Spectrum

FHSS stands for frequency hopping spread spectrum. It's a method of bending the laws of physics to make wireless transmissions less susceptible to interference. Here's how it works.

High-frequency radio waves carry more data, but they bounce off things easier than low-frequency radio waves. For example, a 2.4 GHz WiFi signal can penetrate walls much easier than a millimeter wave 5G connection. So, if we send a wireless communication on a single high-frequency radio wave, there is a good chance we won't receive it thanks to pesky meat space objects.

However, if we divide data into chunks and send those chunks in different frequencies, there is a better chance we will receive most of it. This is the idea behind FHSS.

FHSS divides data into chunks. After data is divided into chunks, the first chunk is sent on one frequency. After the first chunk is sent, the transmitter hops to a different frequency and sends the second chunk of data. And so forth.

The group of frequencies a transmitter can hop between is predefined. Those predefined frequencies are called spectrums. We spread data through spectrum, so it is a spread spectrum, and because the transmitter hops between those frequencies, it is a frequency hopping spread spectrum.