Roll no: 42428
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Experiment No. 10

Title: Set up and carry out experiment on CDMA.

Aim: To Set up and carry out experiment on

CDMA. **Prerequisites:**

1. Concept of multiple access technologies
2. Concept of spreaded code modulation
3. CDMA modulator, demodulator
4. RAKE receiver.

Apparatus:

1. CDMA trainer model
2. Trainer annual
3. DSO
4. Patch cords

Theory:

IS95 is a CDMA system with an addition of FDMA components available, frequency range is divided into frequency bands of 1.25 MHz duplexing is done in frequency domain. In USA, frequency from 1850MHz – 1928MHz are used for the uplink. CDMA provides many advantages over FDMA such as increased capacity. CDMA allows each user in adjacent cell also use the same radio channel.

CDMA eliminates need of frequency scanning each IS95 channel occupies, 125MHz of spectrum on each one way link 270 KHz guard band is provided of each side of spectrum dedication for IS95.

If it is different modulation and spreading techniques for the forward and reverse links on forward channel lease station simultaneous transmits. The user data for mobiles in cell in using a different spreading sequence for each mobile.

On the reverse link all mobile respond in asynchronous fashion and have ideally constant signal level.

CDMA Transmitter, Receiver:

Narrowband message signal is multiplexed by very large BW signals is pseudo random noise code sequence that has signal to noise ratio at the receiver.

A RAKE receiver just attempts to correct the time shifted version of signal by a separate correlation receiver. For each of multiple path signals, each correlation receiver may be adjusted in the delay. Range of time delay that the particular window RAKE receiver is diversity receiver designed CDMA.

Diversity is provided by the fact that multipath components are particularly uncorrelated from one another when their relative propagation delay exceeds a chip rate. Output of each correlated is then weighted to provide a better estimate of the transmitted signal component.

Features of CDMA system:

1. Many users of CDMA system share same frequency; either TDD or FDD may be used.
2. CDMA has soft capacity limit.
3. Channel data rates are very high in CDMA system.
4. RAKE receiver can be used to improve reception by correcting time delayed version of required signal.
5. Self-jamming is problem in CDMA system spreading sequence of different users are not exactly orthogonal.

CDMA trainer board (100P) specifications:

1. Power supply – 230V AC, 50Hz.
2. On board digital data generator -
    a. Word length – 8
    b. Bit clock frequency – 6.66 KHz
    c. Data segment format – NRZ
3. Spreading code mixer to bipolar detector.
4. Modulator type – Coherent binary PSK modulator.
5. Demodulator type – Coherent detector.
6. Low pass filter cut-off – 105KHz
7. Code de-sampling using EX-NOR gates.
8. Standard accessories
    a. Trainer manual
    b. Connecting patch cords.

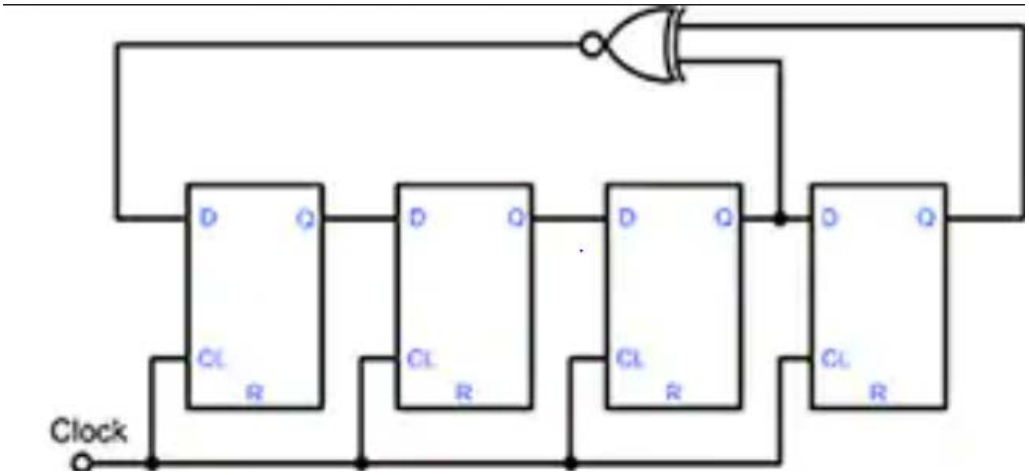

Figure 1 shows CDMA modulator PRN generator is a shift register along with NOR gates & generators 2^n-1 bits PN sequence but it seems a random one for normal receivers.The data is BPSK modulated & multiplexed by a PN sequence, so it becomes DSSS BPSK modulated & then this BPSK modulated & transmitted over channel.

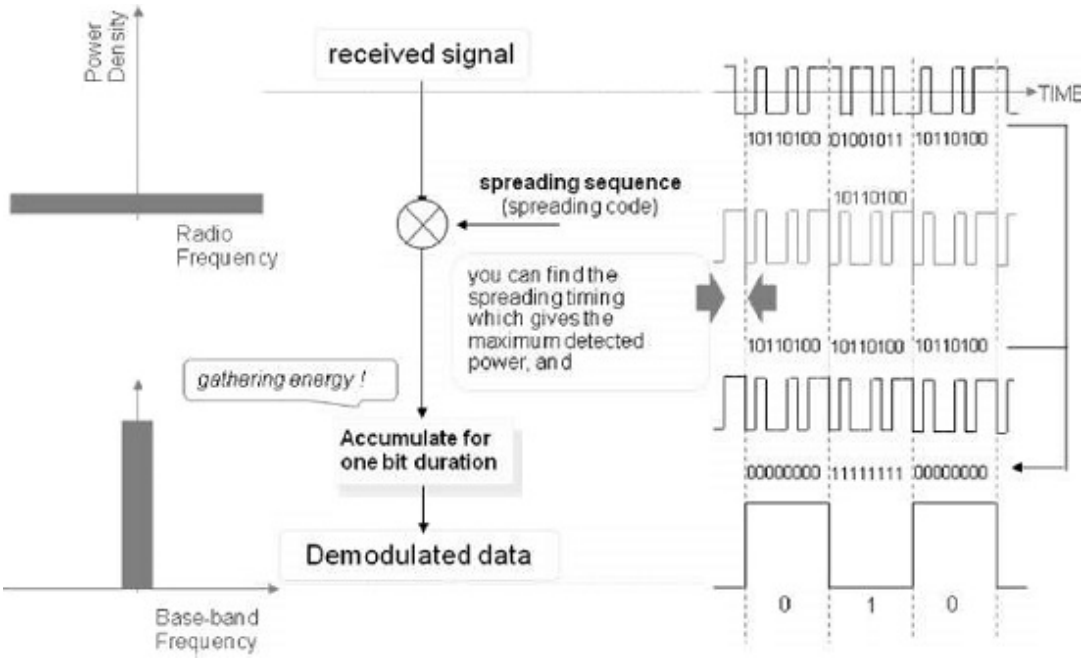

Figure 2 shows demodulator where signal is first dispersed that is the incoming data signal is directly multiplexed by PN sequence & as the input data sequence is bipolar ,output of multiplexer is BPSK signal. Then this signal is multiplied by sinusoidal carrier in order to demodulate it at binary bipolar data signal.

b(t)=bipolar data input signal

D(t)=PN sequence

m(t)=DSSS BPSK signal

r(t)=channel noise

Procedure:

1. Turn on CDMA trainer kit
2. Observe the PN clock, bit clock, carrier clock & RF carrier of DSO.
3. Connect PN sequence generated by PN code generator to operating code mixer.
4. Connect NRZ data input to the spreading code mixer.
5. Convert spreading code to bipolar converter block.
6. Modulate spreaded code to input LPF then dispread code by code dispreading techniques.

Conclusion:

In this experiment we studied the CDMA technique used in GSM, where a bipolar data signal was spreaded by multiplying it with a PN sequence which was generated using Linear feedback shift registers using Ex-NOR gate. This technique is also known as DSSS (Direct Sequence Spread Spectrum). We then demodulated the same Spread signal by multiplying it with the same PN sequence or code and verified that we received the original data sequence correctly.