General

This document is to describe the four types of internal Modems that are used to modulate data for radio transmision in Moscad_L products.
This modems are in use with the P44 UHF 1 (FLN5923A) and UHF2 (FLN5922A) radios.

DFM Modem

The Direct FM modulator produces a 3 level signal in the following principle:
A logic "1" is taken as the mid-level of the transmitted signal while the logic "0" takes values of the upper and lower levels alternately.
The transmitted signal passes through a low pass filter to produce a band-limited signal.

The bit rate is up to 4800 bps.

DFM Modulation - Wave Form Example

T = 1/4800 Sec

Transmitter bandwidth
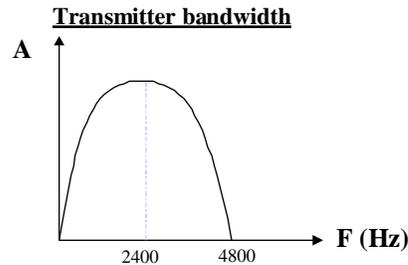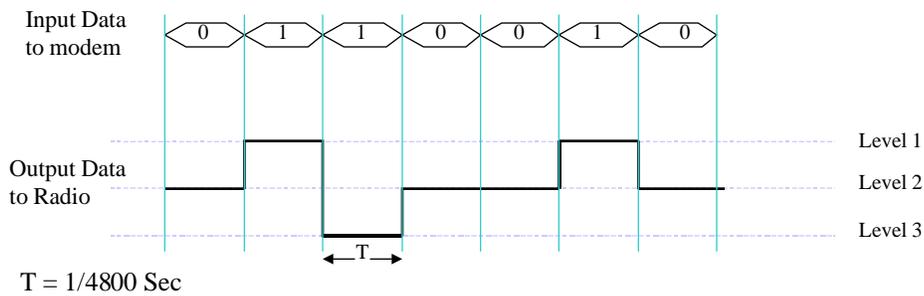
The output data from the modem passes through a low pass filter so the final signal to the radio is in sinus shape with 350mV Pk-Pk.
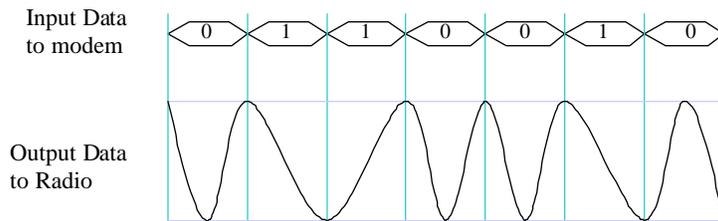(175mV Pk-Pk = 1 KHz deviation in the radio)

FSK Modem

The FSK modulator produces a signal in the following principle:

A logic "0" produces a one period of a sine wave, which its frequency equals to the bit rate.
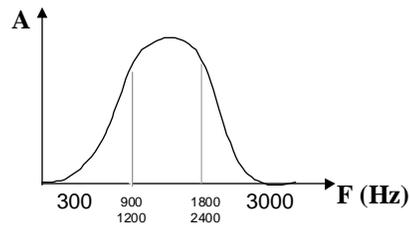
A logic "1" produces a half period of a sine wave, which its frequency equals to the half of the bit rate.

The bit rate is up to 2400 bps.

FSK Modulation - Wave Form Example

Input Data
to modem

| 0 | 1 | 1 | 0 | 0 | 1 | 0 |

Output Data
to Radio

Transmitter bandwidth

A

300   900   1800   3000   F (Hz)
       1200   2400

DPSK

DPSK is a standard v.22 1200 bits per second modem.
It is a Differential Phase Shift Kye modulation on a 1200Hz carrier.
Every two bits in the stream data encoded as a phase change relative to the phase of the previews signal phase.
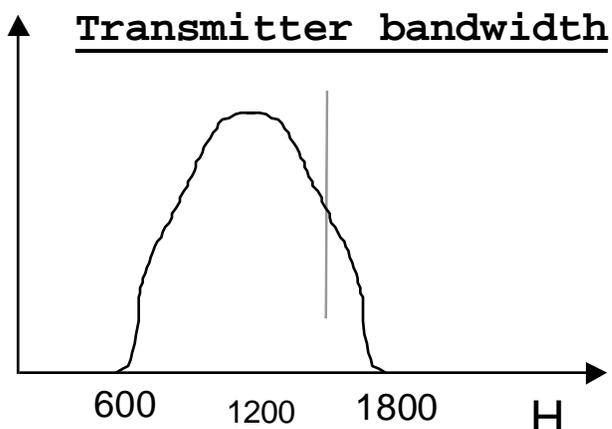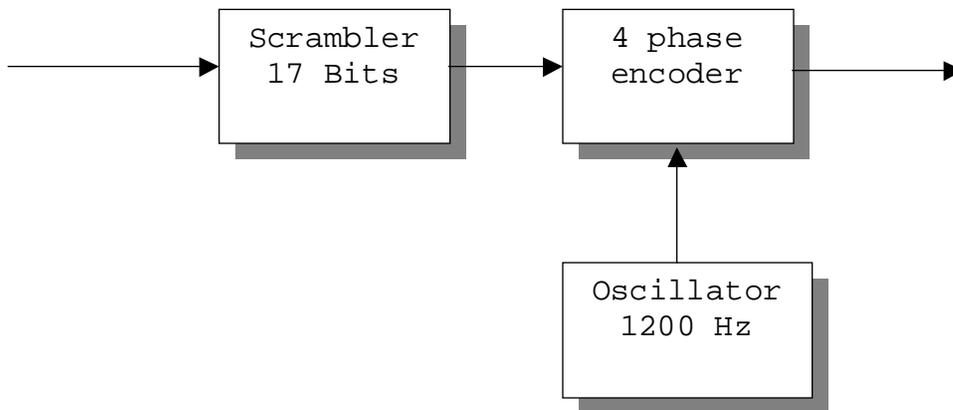The data is entered to the encoded modem modulator after 17 bits pseudo random scrambler.

Phase changes:

Bits	Phase Change
00	+90
01	0
10	+180
11	270

The 3 DB Transmit frequency bandwidth is 900 Hz – 1500 Hz
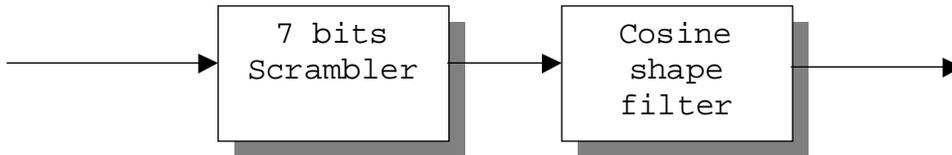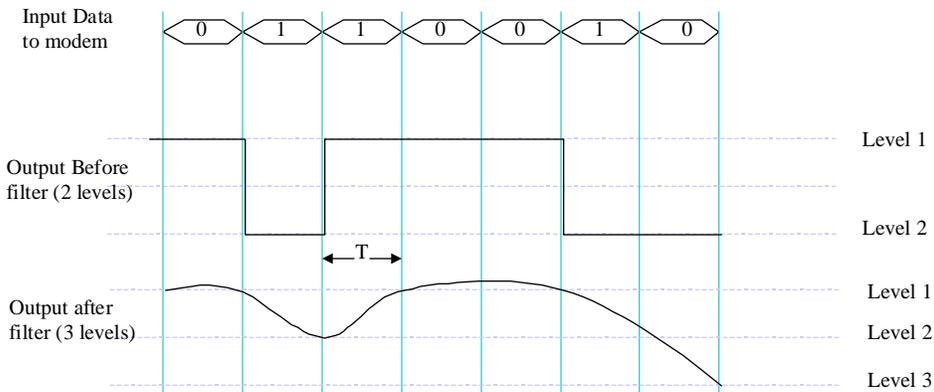Center frequency (carrier) is 1200 Hz +/- 1Hz

COS

Cos is a 9600 bps, 3 level doabinary modem.
The basic operation of the modem is to transfer the data through a filter with a cosine shape. The shape reduces the frequency bandwidth of the transmitted signal to less then 4800 Hz.
Every transmitted bit is encoded and passes through 7 bits pseudo random encoder.

```
           ┌─────────────┐         ┌─────────────┐
           │   7 bits    │         │   Cosine    │
──────────▶│  Scrambler  │────────▶│    shape    │──────────▶
           │             │         │   filter    │
           └─────────────┘         └─────────────┘
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COS Modulation - Wave Form Example

Input Data to modem: 0 1 1 0 0 1 0

Output Before filter (2 levels) — Level 1, Level 2

T

Output after filter (3 levels) — Level 1, Level 2, Level 3

T = 1/9600 Sec

Transmitter bandwidth

A

F (Hz)

2400   4800