

Data Transmission Between Two Computers Situated at a Long Distance.

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Points:

Data in a microcomputer are always in a digital form i.e., as a sequence of 0s and 1s and always in the parallel form. But the digital data cannot be transmitted to a long distance through a bus in parallel because it is difficult to manage and control a (parallel) data bus for a longer distance and that will also become more costly.

The parallel data are then converted to a serial form while it passes through the IC-8251 (USART- Universal synchronous-asynchronous receiver-transmitter) and it is still a serial binary data. But a pure binary signal (square wave) consists of infinite number of sine waves of different amplitudes and different frequencies and therefore its bandwidth will be infinity and the system, through it passes, should have infinite bandwidth. But it is almost impossible to design a system which has infinite bandwidth. So it has to pass through the MODEM (Modulation-Demodulation) unit.

Need for a Modem.

The job of the Modem is to provide binary modulation and subsequently demodulation. By means of binary modulation the two levels of the binary bit i.e., one and zero may be expressed as pure sine waves of two distinct frequencies (Frequency Shift Keying - FSK.), two different phases (PSK- Phase Shift Keying) or two different amplitudes (Amplitude Shift Keying-ASK). Two different frequencies are involved in ASK and only one frequency sine waves are involved in FSK and PSK and thereby the bandwidth of the transmission channel would become minimum.

Why Sine waves?

A standard practice is to employ 2200 Hz for zero and 1200 Hz for one in the binary format for transmission of digital data. By employing sine waves (analog frequency) of higher frequencies higher energies for the waveform will be provided as evident by the equation $E = h \mu$. The higher energy is needed for better transmission of data. Moreover the higher frequency means smaller wavelength smaller antenna size. The wavelength is comparable to antenna size. The exact job of binary modulation/demodulation is being done by the Modem; Modulation means transformation of square wave into sine wave and demodulation means sine waves to square waves.

In this way the binary bits from the transmitter computer passes through USART and through its Modem. Modem is ,in fact, controlled by the control signals produced by its USART. The sine wave is then transmitted through wired or wireless medium after having proper high frequency up linking. The whole process is repeated in an exactly reverse manner when it passes through the Modem and USART of the receiver computer and the process is called demodulation. The received sine waves is converted into the square waves through Modem and the serial data is converted into parallel when it passes through the USART on the receiver side, respectively. Now, when the receiver

computer wants to send its information to the transmitter computer the whole process is sequentially repeated in the reverse way.

Why Sine wave? Minimum number of frequencies or harmonocs.

Why high Frequency? High frequencies involve higher energies which helps transmitting the waveform to a longer distance.

Why binary modulation? FSK, PSK, ASK. It helps converting binary numbers in the form of chain of square waves (square waves have a much bigger number of harmonics which would have needed a a system with a much larger bandwith)) to sine waves (sine waves have much smaller number of frequencies requiring a system with a smaller bandwith).