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LOW-COST DESIGN AND EVALUATION OF WIRELESS COMMUNICATION LINK USING 315MHz AND 434MHz RF MODULES

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Abstract –

A low-cost, short-range wireless communication link that connects two DTEs (Data Terminating Equipment), similar to personal computers, is described in this paper. This interfacing system comprises hardware and software. The PC's serial data port used as the communication port. A 'Null Modem' method is utilized in the design of the RF link in order to simplify the hardware component. To achieve full duplex communication mode, the 315MHz/434MHz low power RF modules are paired with the serial data convertor MAX 232, an ASK modulator, and a demodulator. Functioning of the circuit is ensured for varying range by using Telix file transfer software.

I. INTRODUCTION

Wireless technologies are driving today's world, a world without cables. Today the wireless data networks are spreading around main cities and surrounding areas across the world. End users and corporations are taking advantage of the flexibility, mobility and freedom offered by wireless technologies to access and share information. In the variety of wireless technologies, wireless systems designed by using IR diode/lasers links are advantageous in the matter of freedom from cables and interference of signals, but it suffers by the limitation of 'line of sight propagation'. RF link is a good alternative for cable, fiber and IR link.

Data terminating Equipments (DTE) like PC can communicate with each other by using either Serial or Parallel Communication Ports. Serial communication is one of the oldest mechanisms for devices to communicate with each other. Serial communication ports have comparatively slower transfer speed than parallel ports; still serial communication remains a popular connectivity option for devices because of its simplicity and cost-effectiveness. The most common scenario to connect to computers using serial communication port is a Null Modem Cable.

This paper presents the wireless null modem using low cost - short range Radio Frequency

links to connect PCs without a single cable insight, allowing more freedom to roam.

II. EXPERIMENTAL

This wireless null modem using radio frequency (RF) link, includes a software for controlling a communications hardware for the data transfer, a hardware device for formatting communication.

A. System Block Diagram

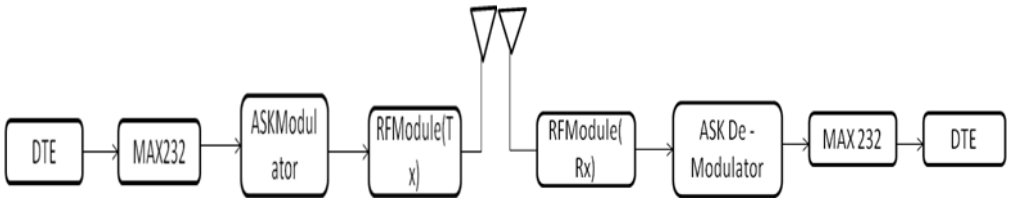

Fig1. Transmitter Block Fig2. Receiver Block

Fig1 and Fig 2 shows the transmitter and receiver block diagrams of the system.

B. Description

DTE: DTEs like PC has 9 pin D type connector as a serial communication port. Connectors pin no 2 and pin no 3 are Data transmitter (TxD) and Data Receiver (RxD) respectively. In Wired Null Modem system to achieve full duplex communication mode TxD pin of 1st DTEs serial port is connected to RxD pin of 2nd DTE serial port and TxD pin of 2nd DTEs serial port is connected to RxD pin of 1st DTEs serial port.

In wireless null Modem system TxD and RxD pins are connected to Input (RE2IN) and Output (TR2OUT) terminals respectively of IC MAX 232.

IC MAX232: The serial port output of a PC is in Non Return to Zero (NRZ) form; this output is converted into digital form using IC MAX232 which is a DUAL EIA-232 DRIVERS/RECEIVERS used as aEIA-232 to TTL/CMOS logic converter.The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA-232 voltage levels from a single 5-V supply. Each receiver converts EIA-232 inputs to 5V TTL/CMOS levels and each driver converts TTL/CMOS input levels into EIA-232 levels.Fig no 3 shows the Connection diagram of Max232 with serial port.

Amplitude Shift Keying (ASK) was the particular scheme chosen because it is relativelye asy to implement as compare to all modulation schemes, also ASKrequires low amount of energy for transmission of data, this help to keep simplicity in design and it is cheap too.

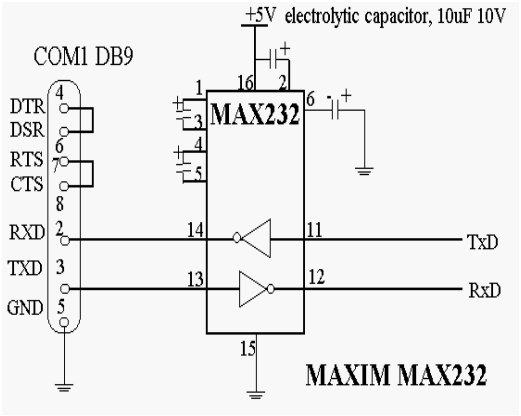

Fig 3. Circuit diagram of Max 232

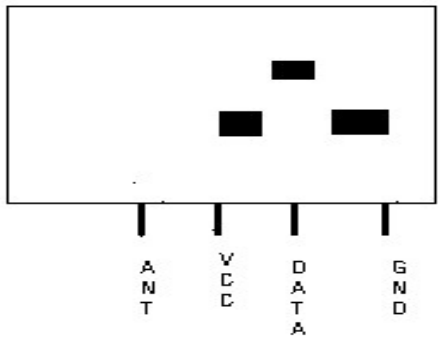

Fig4 Schematic diagram of transmitter module

Transmitter : Transmitter module used for the transmission is SAW RESONATOR TRANSMITTER MODULE (MO- SAWR-A) manufactured by Holy stone enterprise co., ltd. Product identification for 315 MHz is MO-SAWR-AS315M and for 434 MHz is MO-SAWR-AS434M.

It is 434/315 MHz ISM band Transmitter, based on SAW RESONATOR. The MO-SAWR-A is an ASK transmitter module. It is simple to use, the supply voltage required is 1.5 – 12.0 V. Output power of the module is -11.8 to 16 dBm for 315MHz and -8.5 to 16 dBm for 434 MHz. Typically for 5V operating voltage output power is 10dBm for both 315 and 434 MHz transmitters at the data rate of 1kbps. This module supports to the data rate from 200 bps to 10kbps.

Receiver: Receiver module used for the reception is SUPER REGENERATIVE RECEIVER MODULE (MO-RXLC-A)manufactured by Holy stone enterprise co., ltd. Product identification for 315 MHz is MO-RXLC-AS315M and for 433.92 MHz is MO-RXLC-AS434M

It is 434/315 MHz ISM band Receiver basedon asingle-conversion, super-regenerationreceiverarchitecture. It is anASKreceivermodule.TheMO-RXLC-A can usein OOK/HCS/PWM modulation signal and demodulate to digital signal. It can be used in wireless security system or specific remote-control function and others wireless system. It is easy to use; the required supply voltage is 5Volts. The sensitivity is -104dBm for the data rate 1kbps at 315 / 434 MHz frequency at typical operating voltage. The module Supports to data rate from 300bps to 6k bps. Receiving range is 120 m with MO-SAWR-AS 315/434M module in open space.

Receiver modules ASK OUT logic H is min. 3.5V and logic L max. 1.5V for 5V operating voltage, which is compatible for driving the MAX 232 IC.

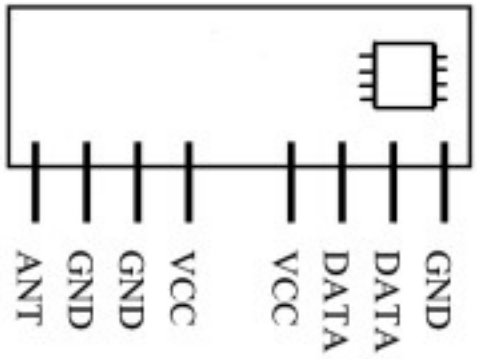

Fig5 Schematic diagram of receiver module.

Antenna: A piece of wire 17.3cm long at 434MHz and 23.8cm at 315MHz is soldered directly to the antenna pin for both Transmitter and Receiver.

Software: To ensure the functionality of the hardware system Telix file transfer software is used. Telix is telecommunication program originally written for DOS by Colin Sambaleanu and released in 1986. Most recent version is released by Deltacom developers including version for windows operating system. Its strength included having fast built in version of the z modem file trans protocol rather than needing a separate program and a powerful scripting programming language similar to C, SALT (Script application language for telix). Telix is written in turbopascal rather than original C language to overcome the problems encountered in windows.

Telix is useful for phone line based services, it supports ANSI emulation and various file transfer protocols.

III. RESULTS AND DISSCUSSION

File transfer is observed by varying the distance between transmitter and receiver blocks, in open space as well as with the obstacles like walls in between. Communication range reported for reception of the file transferred by the telix is maximum in open space and reduced with increase in the no. of walls between the communication path.

TABLE 1 MAXIMUM RANGE OBSERVED

Sr.No.	Experimental Condition	Max. Range
1	No Walls (open space)	55 m
2	One wall	30 m
3	Two walls	16 m

IV. CONCLUSION

It is concluded here that the low cost design of wireless communication link is fabricated and tested successfully and the stable communication ranges is observed in different scenario. This proves system is compatible to be used in home and office.

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