

CHAPTER FOUR

SYSTEM DESCRIPTION AND SIMULATION

4.1 System description

This section contains a description of the environment used to simulate the radio frequency interconnection, the simulation parameters, the simulation process as well as a brief discussion about the results.

Simulation Environment:

Simulation is done through the use of protues8 software, because of its wider libraries and computability of several programming languages like c, c++ and micro avr.

Table 4.1: illustrates the simulation environment parameters

Parameter	Comment
Audio source	To simulate the first responder talking
Capacitor	2 Ceramic capacitor
Relay	2 relays each with two contacts
Transistors	2 npn transistors
Led	2 red leds
DC SOURCE	2 dc sources one with 12v the other with 5v

4.2 Simulation Process

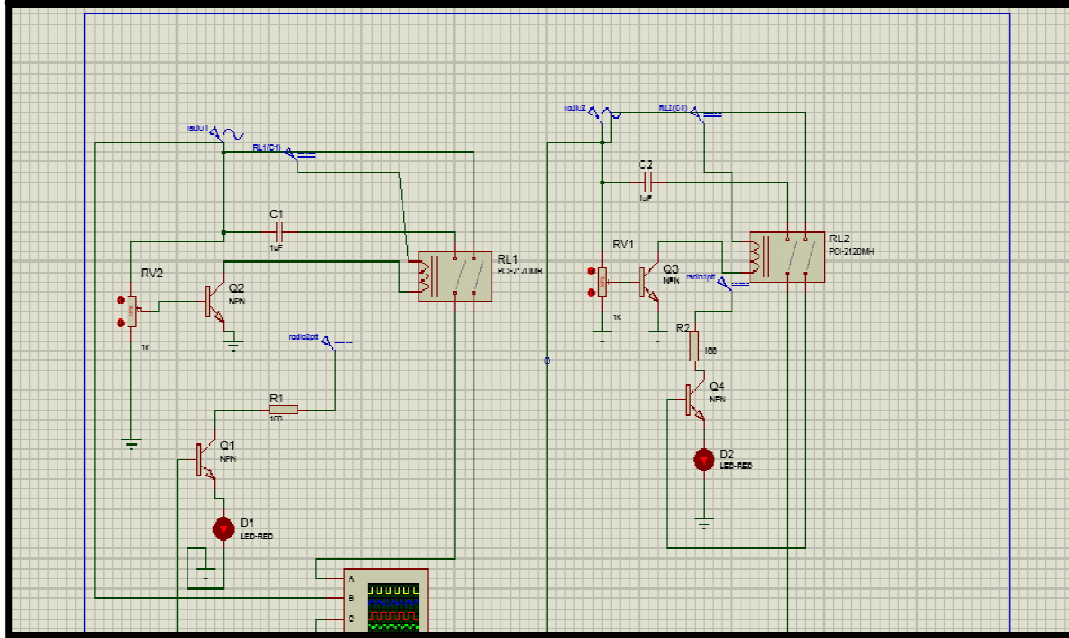


Figure 4.1: simulation circuit

the signal is taken from the receiver radio of org1, this signal passes through a capacitor to ensure an Audio signal free of dc voltage is directed to the base of transistor 1 through a variable resistor. The signal is then passed through a relay (smart switch) to the mic pin of TX of org 2 which is controlled by the switching NPN transistor. The NPN transistor is controlled by the variable resistance, which controls the transistor1 base current. When the variable resistance has a small value the transistor1 is ON then the relay relays the signal to the transmitter radio of org 2, and when the variable resistance has a high value the transistor is OFF and there is no relayed signal. The relayed signal will trigger the transmitter of the radio of org2 (changing in to transmitting mode).

to explain how the transmitter is triggered it is shown in figure(4.1) above the mic is ON by the the dc voltage from the audio signal mentioned obove that passes through relay in key 2 to transistor(2). That activates the base current of transisto2r the collector of this trasistor conntcted to PTT (5 volts) of TX radio org2 .when this transistor is ON the PTT is grounded and the radio of org 2 transmittes the signal and the light emmiting diode is used to indicate that the tx radio of org2 is in TX mode .

4.3 Simulation Results

An experiment has been done for the two- way radio to evaluate the performance of the interconnection between the organizations of different frequency band. The indoor environment has been designed as shown in Figure 4.1.

4.3.1 DC Voltage with Audio Signal:

Most audio signals contain offset voltages which is difference between the signal used and the signal that system sees. For operational amplifier and many other electronic devices its input voltage must be applied to force the output zero.

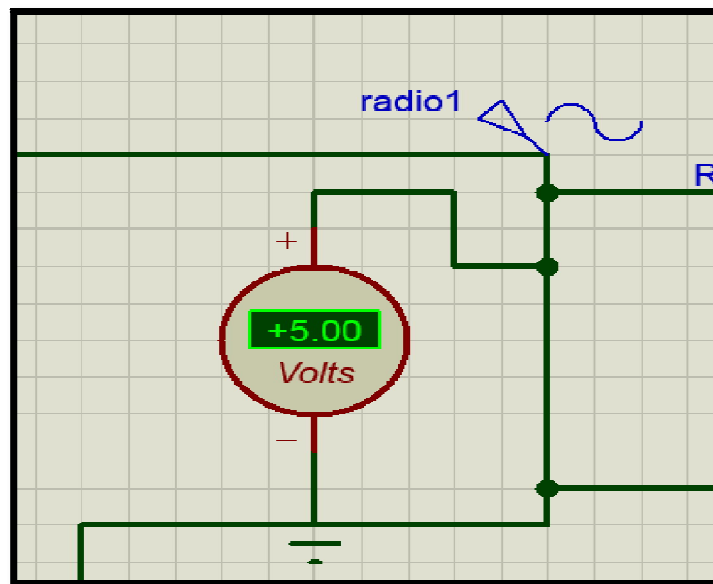


Figure 4.2: offset voltage

4.3.2 Audio From Source and Response Of The Relay

Samples of audio signals are taken to show the responsiveness of the relay, samples with different frequency and different amplitudes.

audio from source is in blue and from relay is in yellow as shown below:

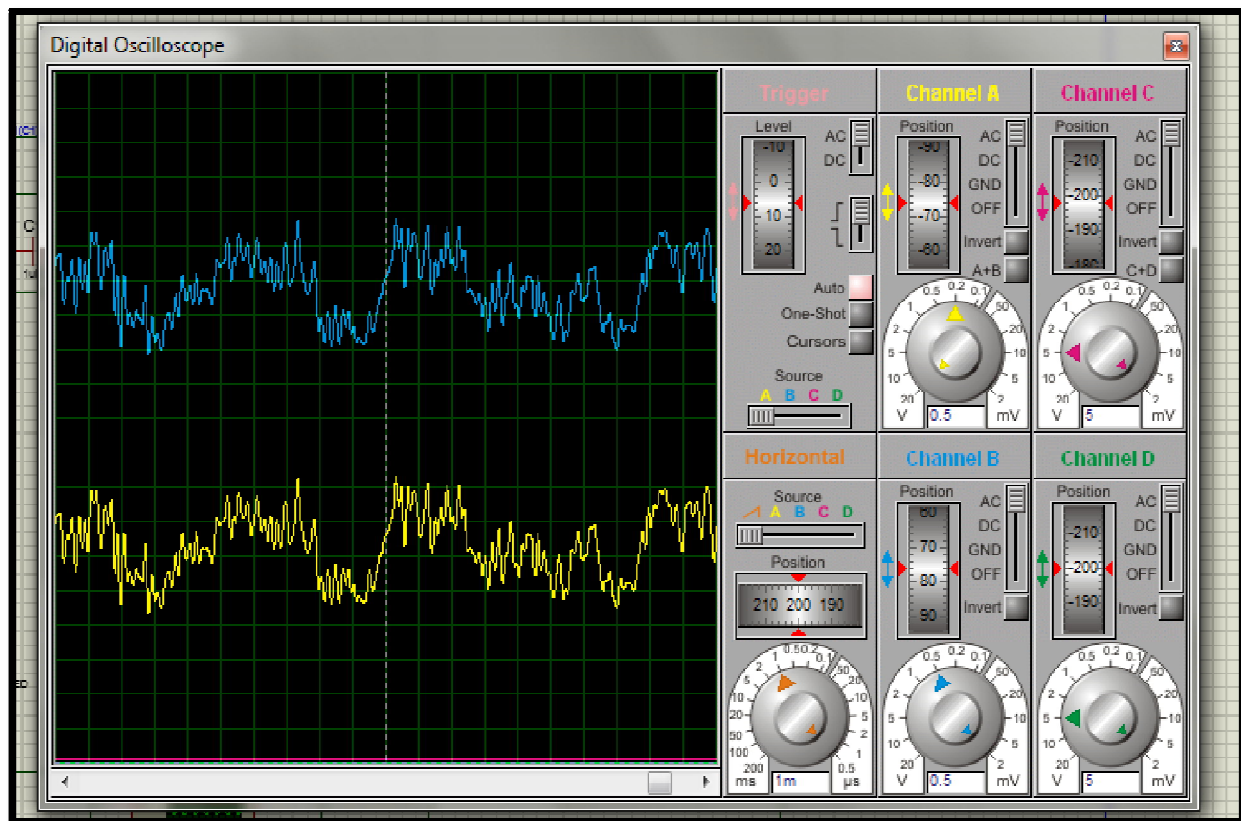


Figure 4.3: first sample of audio signal

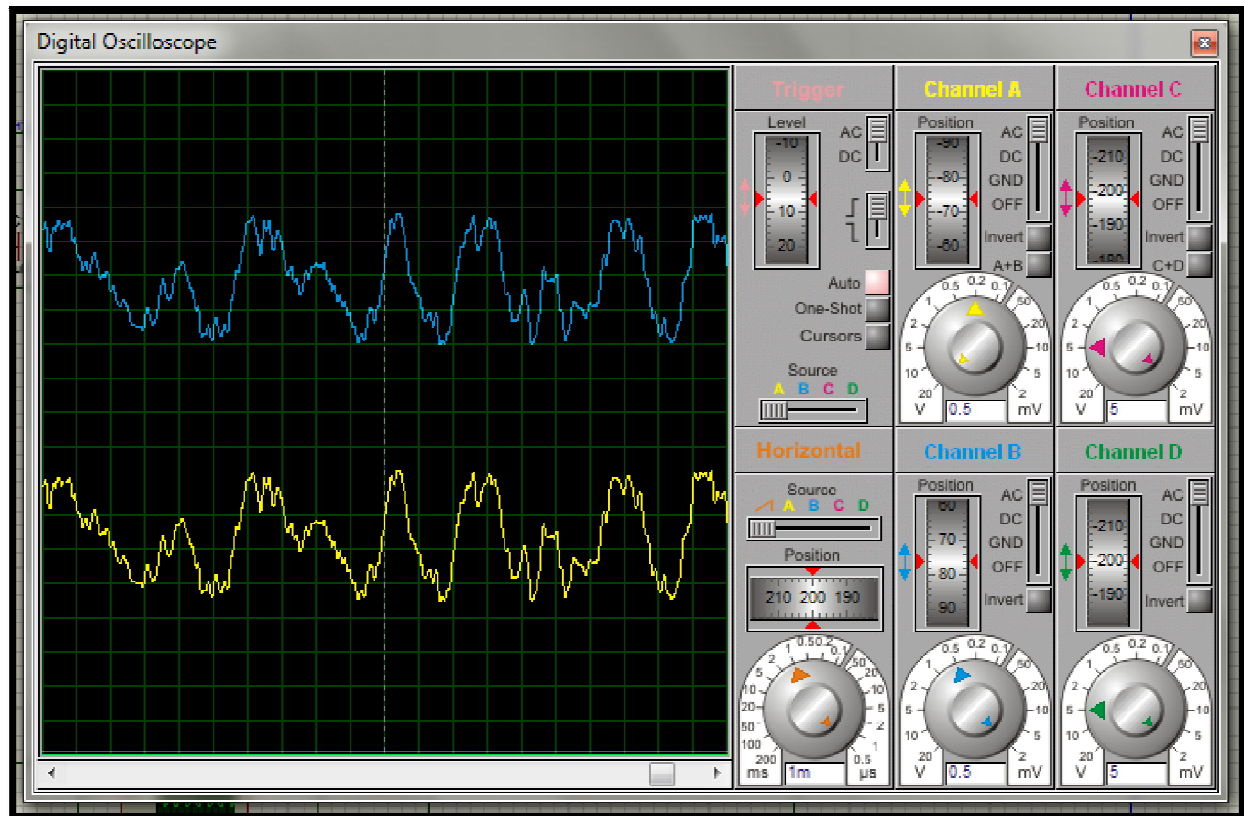


Figure 4.4:second sample of audio signal

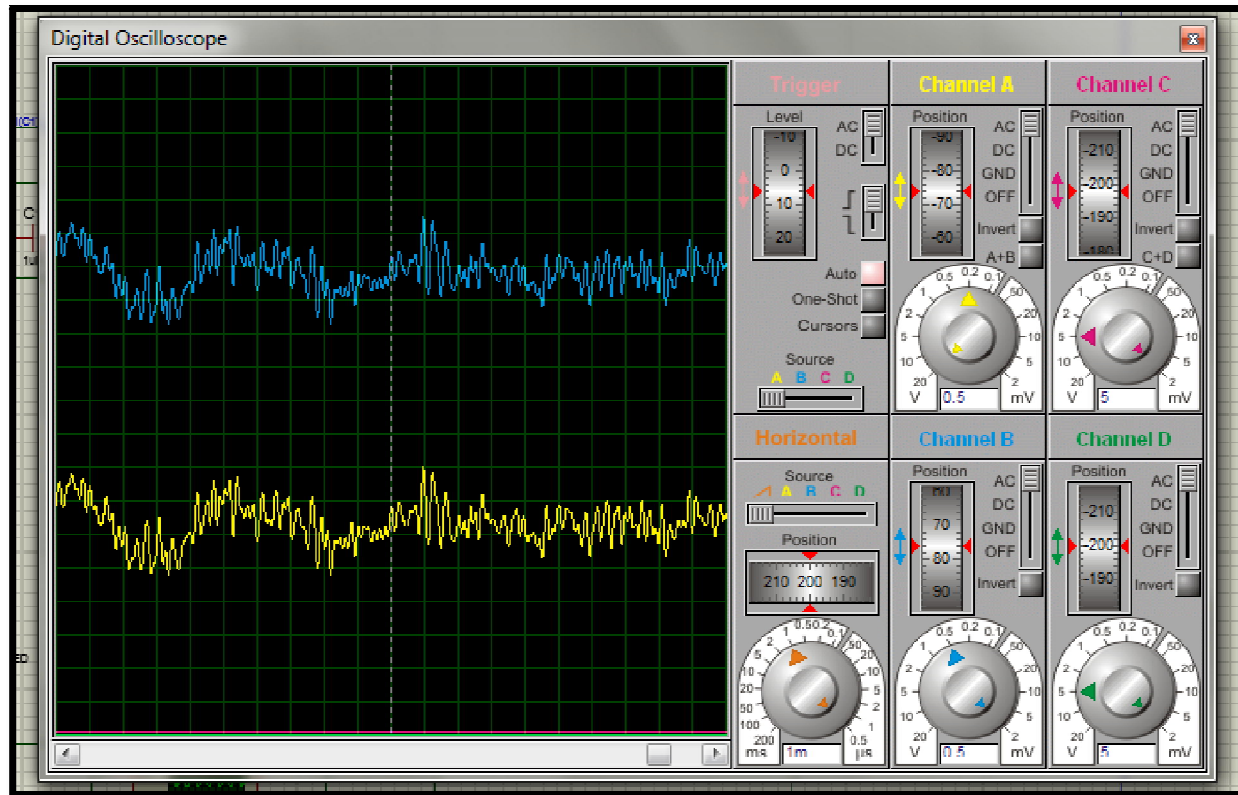


Figure 4.5:Third sample of audio signal

4.3.3 Noise is Added After Passing The Relay :

There is no noise added to the audio from relay after passing relay as shown below

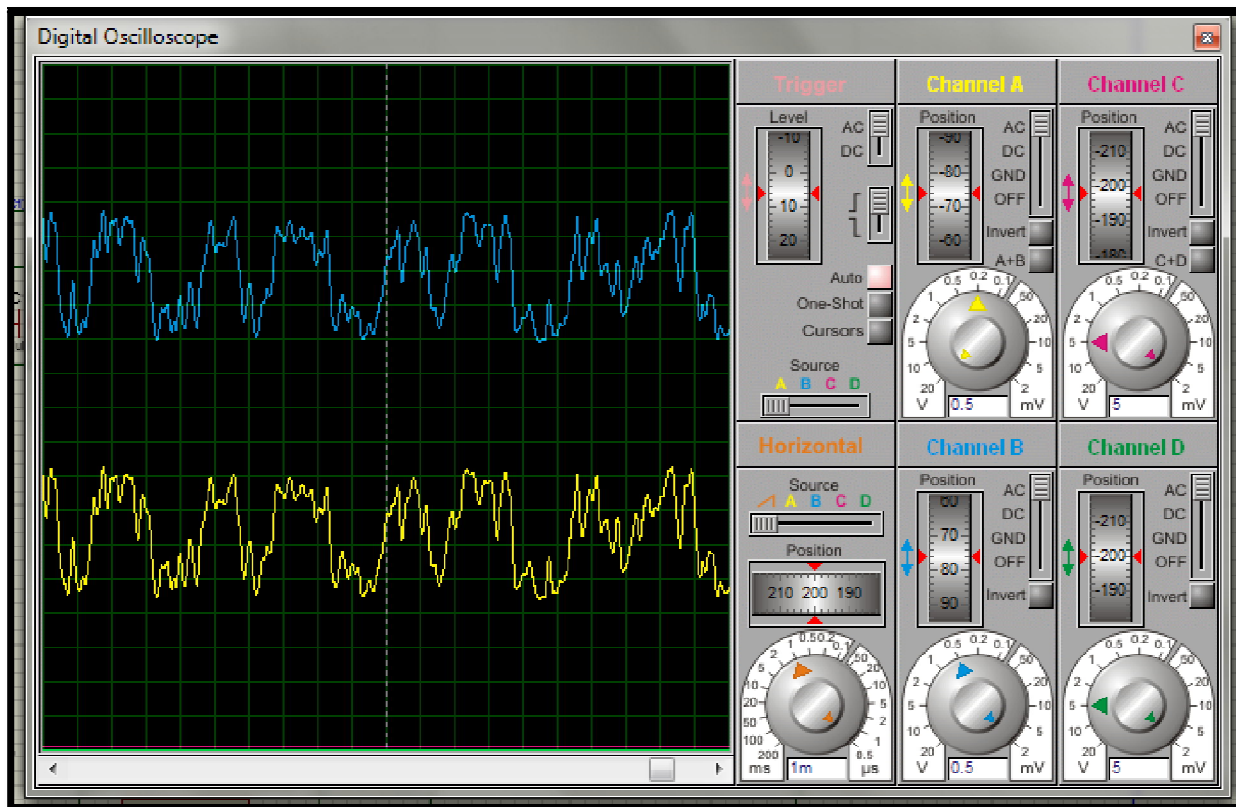


Figure 4.6: noise added from relay

4.3.4 Delay in Signal After Passed From Relay:

Relay doesn't have delay in passing signal it passes it immediately when arrive its contacts as shown below:

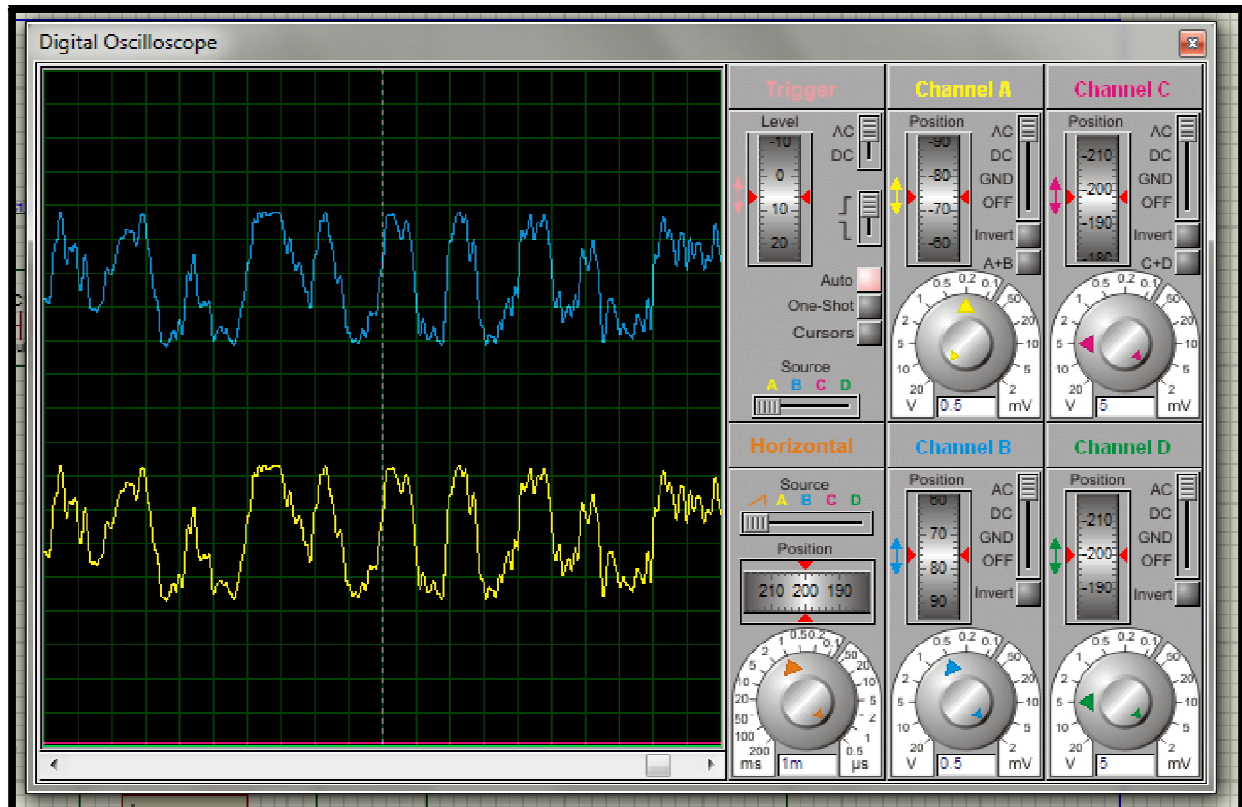


Figure 4.7: delay from relay

4.4 Discussion

At the end of the design and running the simulation, the signal comes from the first responder And passes through a capacitor to reject any flowing of any dc component, then the signal is passed to the relay to control it (pass or not pass). The relay is controlled by a switching NPN transistor so when transistor is ON the relay passes the signal and when it's OFF it doesn't pass the signal.

After the signal is passed from the relay another transistor is used to switch ON the MIC of organization two, after that the signal is then broadcasted at organization two network which is totally different from organization one bandwidth.