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Design and Development of Mobile Phone Jammer

Oyediran Oyebode Olumide[1], Ogunwuyi Ogunmakinde Jimoh[2], Lawal Akeem Olaide[3]

[1]*Department of Computer Engineering, Osun State Polytechnic Iree, Osun State, Nigeria*
[2,3]*Department of Elect/Elect, Osun State Polytechnic Iree, Osun State, Nigeria*

Abstract: *This paper presents the design, implementation, and testing of a dual-band mobile-phone jammer. This jammer works at GSM 900 and GSM 1800 simultaneously and thus jams the four well-known carriers frequency in Nigeria (MTN, GLO, AITEL and ETISALAT). This paper went through two stages: Stage one: studying the GSM-system to find the best jamming technique, establishing the system design and selecting suitable components. Stage two: buying all the needed components, drawing the overall schematics, assembling the devices on a well known Veroboard, performing some measurements and finally testing the mobile jammer. The designed stage consist of voltage controlled oscillator, noise generator and Radio Frequency Amplification. MATBLAB Simulink 8.4 was used for the simulation of the frequency oscillator, On Running the simulation, and observing the output of the scope, a signal whose carrier repeatedly moves from 10.6927 to 10.9786 MHz was observed . We can see that the result was a signal at frequency RF covers the whole downlink The designed jammer was successful in jamming the four carriers in Nigeria operating on EDGE or 2G network*

Keywords: *GSM900, GSM1800, Jammer, Airtel, MTN, GLO, MATLAB, RF*

I. Introduction

Mobile jammers were originally developed for law enforcement and the military to interrupt communications by criminals and terrorists to foil the use of certain remotely detonated explosives. The civilian applications were apparent with growing public resentment over usage of mobile phones in public areas on the rise & reckless invasion of privacy. Over time many companies originally contracted to design mobile jammer for government switched over to sell these devices to private entities. As with other radio jamming, mobile jammer block mobile phone use by sending out radio waves along the same frequencies that mobile phones use. This causes enough interference with the communication between mobile phones and communicating towers to render the phones unusable. Upon activating mobile jammer, all mobile phones will indicate "NO NETWORK**".** Incoming calls are blocked as if the mobile phone were off. When the Mobile jammers are turned off, all mobile phones will automatically reestablish communications and provide full service. Mobile jammer's effect can vary widely based on factors such as proximity to towers, indoor and outdoor settings, presence of buildings and landscape, even temperature and humidity play a role. The choice of mobile jammers are based on the required range starting with the personal pocket mobile jammer that can be carried along with you to ensure undisrupted meeting with your client or a personal portable mobile jammer for your room or medium power mobile jammer or high power mobile jammer for your organization to very high power military jammers to jam a large campuses.

II. Related Works

The rapid proliferation of mobile phones at the beginning of the 21st century to near ubiquitous/ever present status eventually raised problems such as their potential use to invade privacy or contribute to rampant and egregious academic cheating. In addition public backlash was growing against the intrusive disruption cell phones introduced in daily life. While older analogue mobile phones often suffered from chronically poor reception and could even be disconnected by simple interference such as high frequency noise, increasingly sophisticated digital phones have led to more elaborate counters. Mobile phone jamming devices are an alternative to more expensive measures against mobile phones, such as Faraday cages, which are mostly suitable as built in protection for structures. They were originally developed for law enforcement and the military to interrupt communications by criminals and terrorists. Some were also designed to foil the use of certain remotely detonated explosives. The civilian applications were apparent, so over time many companies originally contracted to design jammers for government use switched over to sell these devices to private entities. Since then, there has been a slow but steady increase in their purchase and use, especially in major metropolitan areas.

2.1 **Mobile Telephone Service (1946- 1984):** This system was introduced on 17th of June, 1946. Also known as Mobile Radio-Telephone Service. This was the founding father of the mobile phone. This system required operator assistance in order to complete a call. These units do not have direct dial capabilities.
2.2 **Improved Mobile Telephone System (1964-present):** This system was introduced in 1969 to replace MTS. IMTS is best known for direct dial capabilities. A user was not required to connect to an operator to complete a call. IMTS units will have a keypad or dial similar to what you will find on a home phone.
2.3 **Advanced Mobile Phone System (1983-2010):** This system was introduced in 1983 by Bell Systems; the phone was introduced by Motorola in 1973 and released for public use in 1983 with the Motorola 8000. Advanced Mobile Phone System (AMPS) also known
as 1G is an improvement of IMTS.

2.4 Block diagram

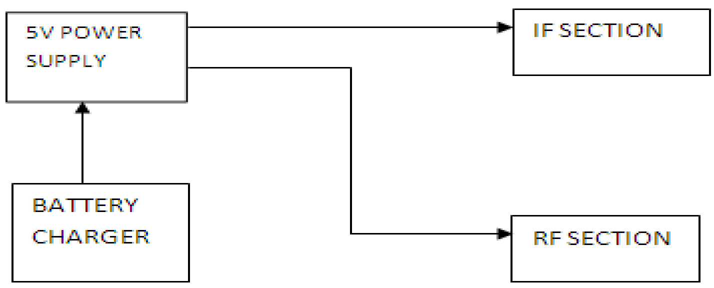

Figure 1: Block Diagram of Mobile Phone Jammer

2.5 Voltage Controlled Oscillator

A voltage controlled oscillator (VCXO) generates radio frequency (RF) signals that will interfere with the cellular phone signal. A VCXO uses an input voltage to determine its oscillation frequency. It can also receive a changing voltage to produce an oscillation with modulated frequency. VCXOs can be harmonic or relaxation types. Harmonic VCXOs produce sinusoidal waveforms; they have greater stability than relaxation VCXO over changes in noise, power supply and temperature. They also posses greater frequency control. Relaxation VCXOs produce triangular shaped waveforms.
At the heart of the RF jammer is a VCO, the device that generates the RF signal which will interfere with the cell phone, GPS receiver, etc. There are three selection criteria for selecting a VCO. Firstly, it should cover the bands that a user wants to jam.

a. Noise Generators

Noise Generator Circuit (NOISE): A noise generator is a circuit that produces electrical noise which is a random and non-deterministic signal. A lot of overlooked systems are noise sources; these include a rowdy room with everyone talking at different pitches (frequency), loudness (amplitude) and so on. A simple microphone as a transducer can be used to pick up such signals. In the field of electronics though, noise can be generated by different means. This includes a resistor exhibiting thermal noise (heated resistors), a Zener diode (exhibiting avalanche effect), temperature limited vacuum diodes, special circuits and gas discharge tubes. This project uses a zener diode in reverse bias, turning the zener diode to exhibit avalanche effect which is a noise generator and industrial (man-made) noise readily in the environment.

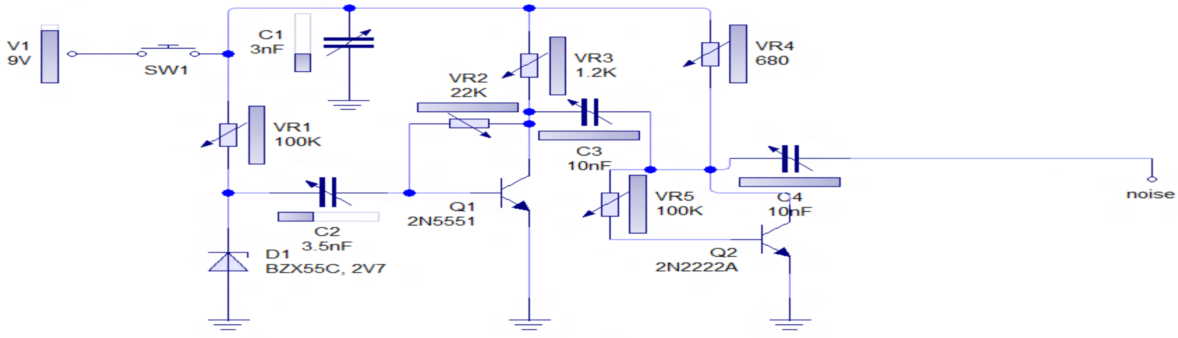

Figure 2: Noise circuit with zener diode in reverse bias.

III. Methodology

3.1 Power supply and Cooling Unit

Power system: The power system comprises of all subsystems working together to produce desired voltage levels which drive various circuit sections of the jammer. These include; Bridge rectifier, filter circuit, voltage regulators, and fuse.

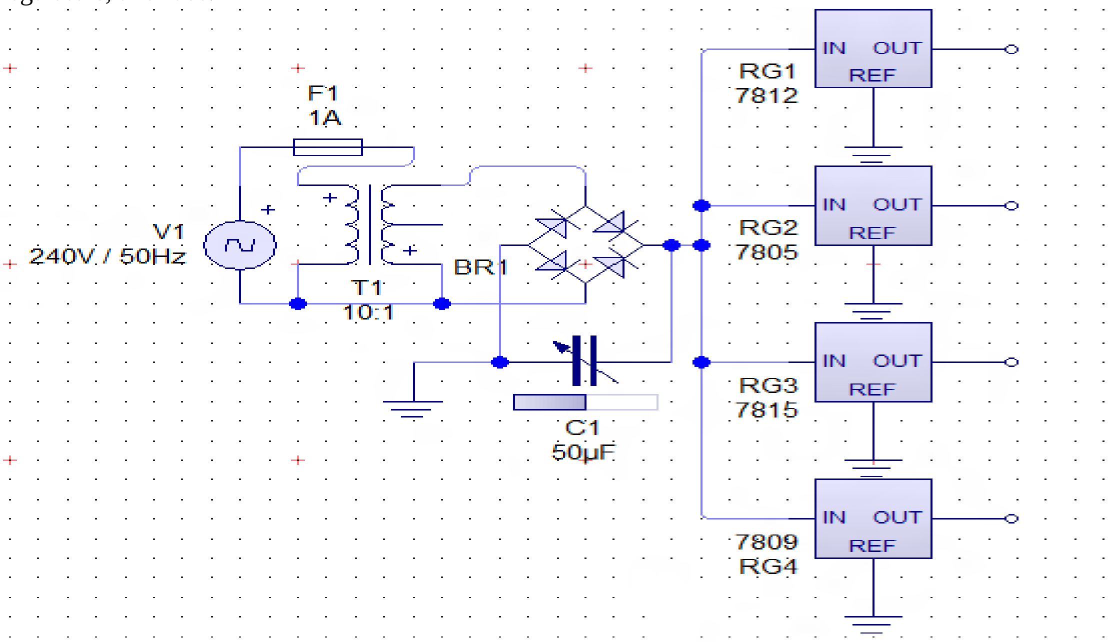

Figure 3: **Intermediate Frequency Unit**

The intermediate frequency which is a driving frequency for the radio frequency part consists of the following parts:

Common Emitter NPN-Transistor Amplifier (CE NPN): This circuit is the first processing stage of the noise signal. The NPN transistor in common emitter mode (CE) amplifies the weak noise generator signal.

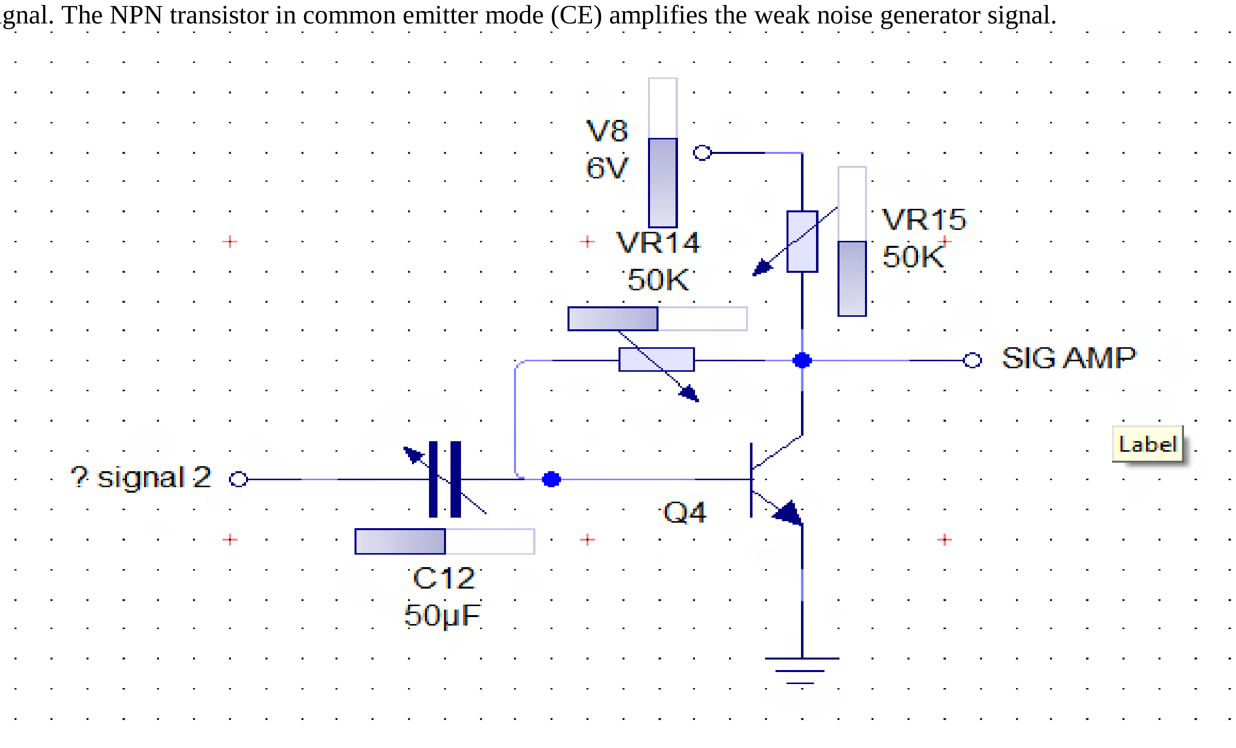

Figure 4: Common emitter signal amplifier

Low Voltage Power Amplifier (LVPA): This circuit is the second stage of the noise signal processing and increases the power level of the amplified noise (first stage). It utilizes an operational amplifier (LM386) which is a Low voltage power amplifier.

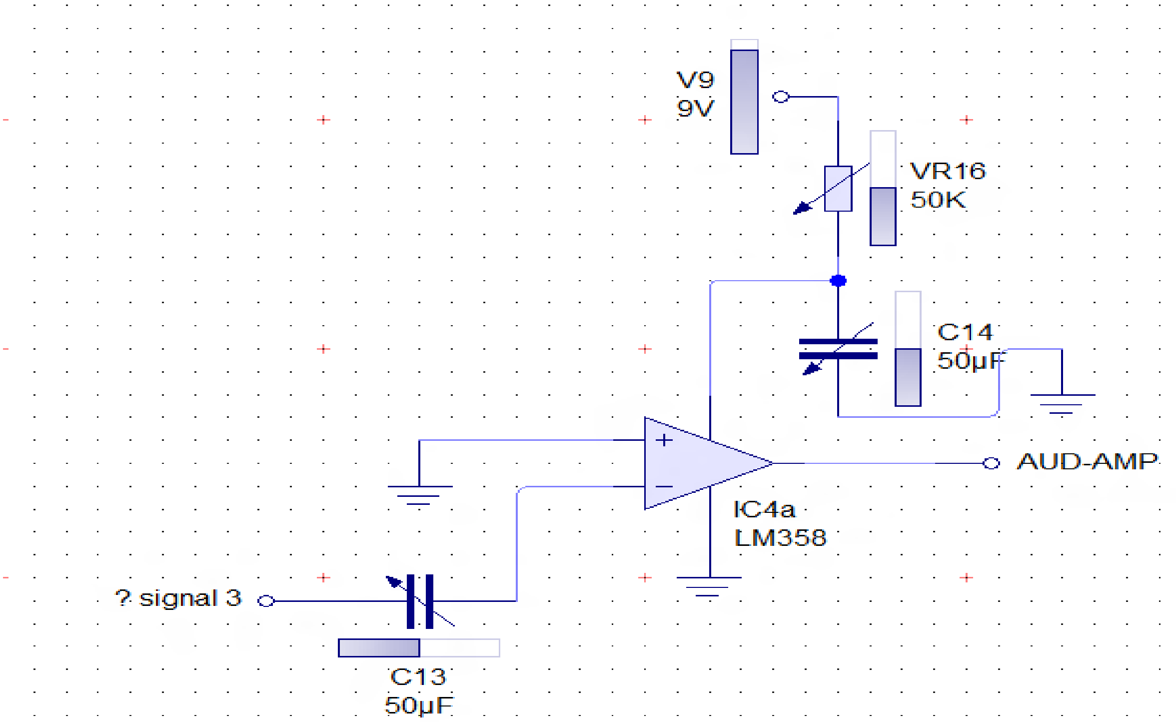

Figure 5: Audio amplifier using LM386 Opamp

Sweep Generator Circuit (SWP): A ramp signal is a linear increasing voltage waveform; it is used to modulate the VCXO so as to sweep jamming frequency over the entire band. The time period of the Ramp signal determines the rate at which the jammer sweeps the target band. The sweep generator is needed to tune the VCXO to the right frequencies at the right time. VCXOs are devices that produce RF signal which could be Triangular in nature (as in Relaxation types) or Sinusoidal (as in Harmonic types). The RF signal so produced is a function of the input voltage at the Voltage input pin of the VCXO. By creating a ramp or triangular waveform which is characterized by an increasing voltage with respect to time, it means it is possible to make the VCXO span wider range of frequencies. Since the VCXO is flexible in this sense, tuning circuit was designed to match its specifications with factors such as linearity, sensitivity and deviation put into consideration.

Summer Circuit (SC): A summer circuit is required to combine the signal waveforms produced by the sweep generator and the noise source in preparation to be fed into the VCXO. This project utilizes an operational amplifier, OP-AMP LM741 in summer mode configuration.

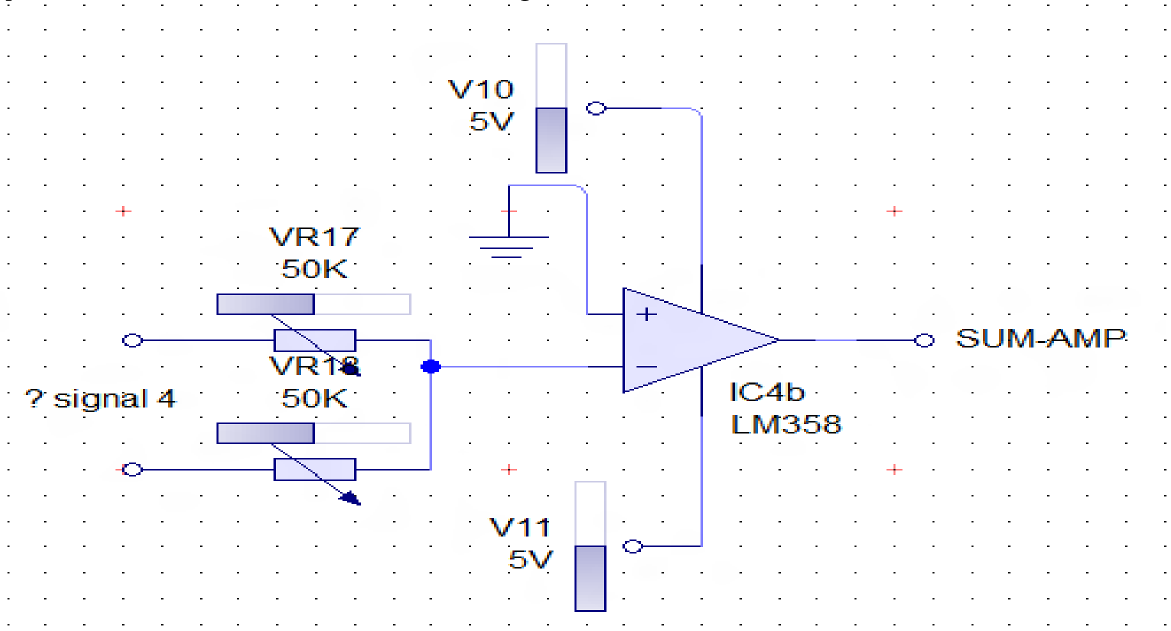

Figure 6: Summing amplifier

Clamper Circuit (CC): VCXO have specified input voltage levels below which the oscillator is OFF as specified by its datasheet. The aim of the clamper circuit is to raise the voltage to an acceptable level for the operation of the VCXO. The clamper circuit comprises of a Diode-Resistor-Capacitor and a voltage source to create an offset.

Clipper Circuit (CLC): The clipper circuit is necessary after the microphone stage to ensure that output levels of the microphone does not exceed certain limits to distort the normal frequency sweeping of the VCXO. This circuit consists of a diode, resistor and voltage source.

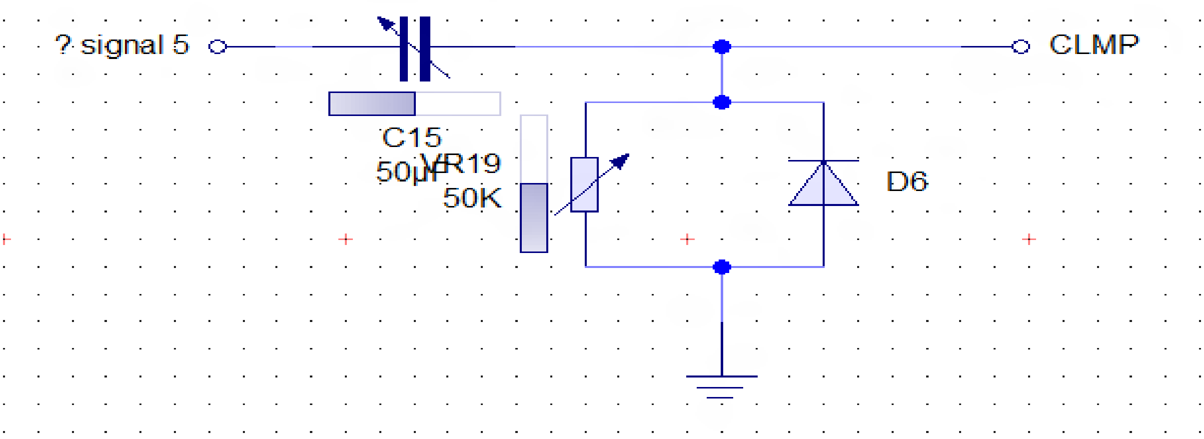

Figure 7: Signal clamper

3.4.4 Radio frequency Amplification

This requires the use of solid state power amplifiers to amplify jamming signal to levels that satisfy the jamming performance criteria.

RF Power Amplifier (RF-PA): The RF Power amplifier is an Integrated circuit (IC) which increases the power at its input to a finite value as designed for. The GSM jammer requires a maximum power output of 2W or 35dBm and as such, the RF-PA IC was purchased to work for the dual band frequencies and at the same time cater for the required power level.

3.4.5 Antenna Unit

Antenna Feed-line (FEED): Antenna Feed-line comprises of all components that makes the jamming signal arrive and radiate at the antenna efficiently and successfully. It is worthy of note that for maximum power transfer of any electrical system, the input impedance of such a system must match with its output impedance. A 50 ohm Micro-strip line performs impedance matching as the use of lumped elements and resistor networks is limited to low frequency applications. The impedance matching must be done to prevent an unacceptable VSWR (voltage standing wave ratio) which will create signal reflections and reduce the efficiency of the jammer or prevent it from functioning.

IV. Result and Discussions

4.1 SIMULATION

A Matlab/Simulink simulation to show the generation of fREF was carried out to illustrate the behavior of the oscillating generated signal. The block diagram modeling the oscillator is shown below. The simulation was done with Matlab /Simulink 2012.

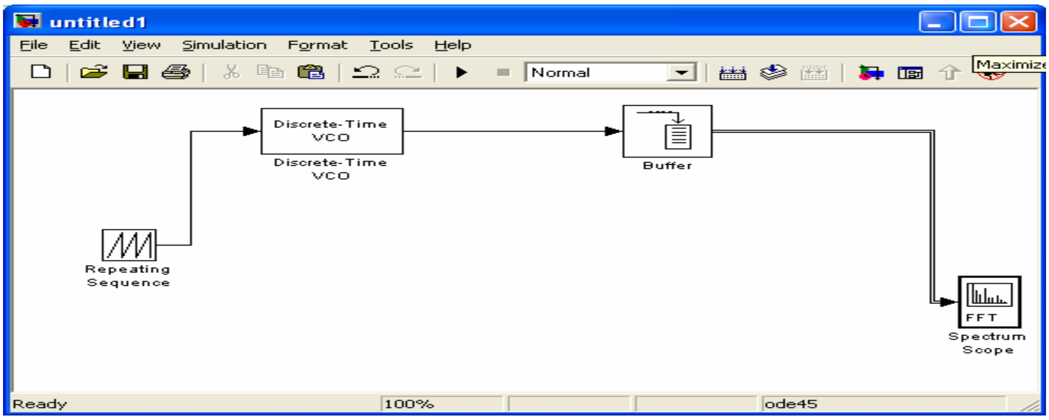

Figure 8: Block diagram of the varying frequency oscillator

where the repeating sequence block represents the periodic input signal to the VCO (more specifically the varying voltage at the pins of the variable capacitor) In the simulation it is considered to be a triangular signal but any periodic signal would lead to the same results. The signal was given a triangular variation from 0 - 5v and a period of 0.2885 msec1. The VCO which represents the oscillator formed by the varactor and an inductor, the range to be traversed by fREF is 285.9 KHz which corresponds to a 5v variation in the input signal and thus a sensitivity of 57.11 KHz/volt. A Discrete-time VCO was used to allow the use of the fast fourier transform to analyze the signal. The last part is the buffer and the FFT which help construct the frequency domain representation of the output signal achieved.

4.2 Results

On Running the simulation, and observing the output of the scope, a signal whose carrier repeatedly moves from 10.6927 to 10.9786 MHz . we can see that the result is a signal at frequency RF cover the whole downlink.

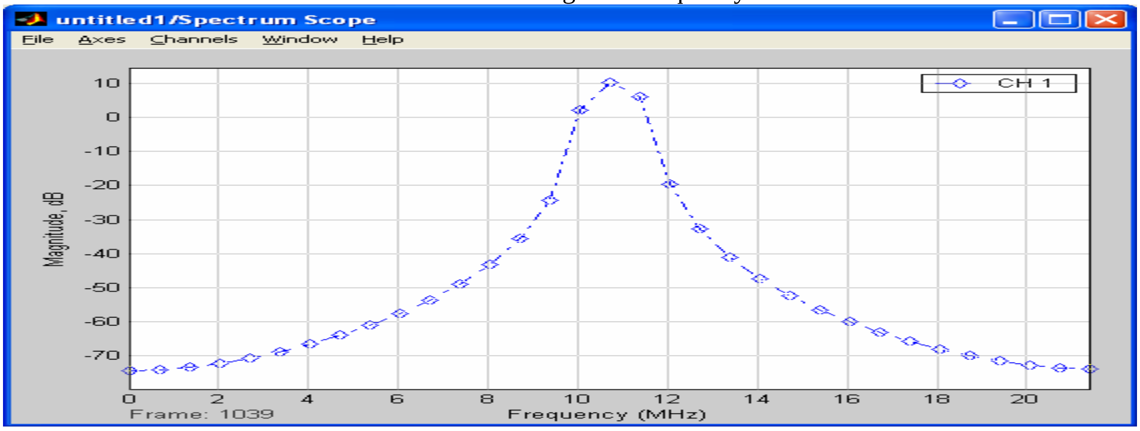

Figure 9: Simulation Result

V. Conclusion

The device was able to jam the four major cell phone carriers in Nigeria: MTN, GLOBACON, AIRTEL and ETISALAT. The effective jamming range was around 50 meters on AC and around 30metres on DC. From the research carried out on this paper, it was observed that as the distance between the cell phone and the base station increases, the effective jamming distance will increase. This is due to the fact that the amount of power reaching the cell phone from the base station decreases as the cell phone moves farther from the base station

This paper is effectively designed and tested working properly on 2G network. Hence, by designing this project GSM CDMA, 3G mobile phone signals are blocked within the given time
schedule i.e. a range of 850MHz to 2170MHz frequencies are blocked.

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