Jamming Demonstration by Denial-Of- Mobile Service (DOS) using Extrinsic Noise for Audience Improvement in University's Environment

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Abstract:- This paper reports the result of a research carried out in Osun State University, Osogbo, Nigeria to improve audience in lecture rooms and other environments using a locally constructed mobile phone jammer. The jammer suspended communication activities by denial-of- mobile service (DOMS) using extrinsic noise for audience improvement in university's environment. It (the jammer)was constructed employing extrinsic (man-made) noise. This jammer transmits an interference signal on the downlink of the popular GSM 900 MHz and DCS 1800 MHz frequency bands. It comprises of an intermediate frequency (IF) circuit, a radio frequency transmitter (RFT), an antenna and a power source. The IF circuit generates a ramp signal using a 555timer, this ramp signal is mixed with two noise sources, the extrinsic noise sensed by a high sensitivity microphone and a zener diode noise source; the resulting IF signal is fed to the RFT. At the RFT, the ramp signal tunes the voltage controlled crystal oscillator to desired frequency range. This produces an interference radio frequency (RF) signal on the same frequency as the downlink of the GSM and DCS cellular system. The resulting interference RF signal is amplified to cover a radius of 10 meters which implies an area of 628m^2. Finally, a test was carried out to investigate the effect of the mobile phone jammer in eliminating phone activity at various locations on campus. This took place over a period of one semester (4 months). Expectedly, out of 343 cases whereby mobile phone activity was prevalent in form of circuit and packet switching (phone calls, text messages, and data connection) without the use of a jammer, this figure diminished greatly to 8 cases upon the activation of the jammer; at same locations and periods. It is therefore obvious that the commandeering of the mobile communication system in educational institutions can be efficiently achieved by the use of a mobile phone jammer.

Keywords: *jammer, ramp-signal, communication, frequency, noise, extrinsic-noise, interference, denial-of- mobile service.*

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INTRODUCTION

A mobile phone jammer prevents communication with a mobile station or user equipment by transmitting an interference signal at the same frequency of communication between the mobile station and a base transceiver station. This work employs a system known as "active denial of service jamming" (Mika, 2000). Here, a noisy interference signal is constantly radiated into space over a target frequency band and at a desired power level to cover a defined area. This jammer works dual-band and jams the downlink frequencies of the global mobile communication band (GSM 900 MHz) and the digital cellular band (DCS 1800 MHz) employing noise extracted from the environment. It jams three well-known carriers in Nigeria (MTN, AIRTEL and ETISALAT).

The operational block of the jamming system is divided into two sections: Intermediate frequency (IF) section and the Radio frequency transmitter (RFT). The IF section comprises a noise circuit which extracts noise from the environment using a high sensitivity microphone. Examples of extrinsic or man-made noise include noise from rotating fans, automobile, loud discussions and so on. The noise is mixed with a tuning (ramp) signal which tunes the voltage controlled crystal oscillator in the RFT section to cover certain frequencies. The RFT has a power amplifier while the last element is the antenna. Upon activation of the mobile jammer, all mobile phones will indicate "No-Network", "SOS" or "Searching-For-Service**",** and all phones within the effective radius of the jammer are denied access. Incoming calls are blocked as if the mobile phone were off. When the mobile jammer is turned off, all mobile phones automatically re-establish communications and provide full service.

In conclusion, a jammer employing man-made (extrinsic) noise was constructed to interfere with mobile phones in places where mobile phone usage is disliked, offensive or forbidden. This paper has been written to investigate the

elimination of mobile phone activity in university community using the mobile phone jammer.

It worth mention that Communication system technology uses a technique known as frequency division duplexing (FDD) to serve users with a frequency pair that carries information at the uplink and downlink without interference. Fig. 1 shows the GSM FDD structures. Any break in either uplink or downlink transmission results into failure of the communication link. On the downlink, the Broadcast Control Channel (BCCH) is one of the logical channels of the GSM system. It continually broadcasts information including base station identity, frequency allocations, and frequency-hopping sequences. This provides cell specific information including information necessary for the mobile station (MS) to register at the system. One of the important sub-channels on the BCCH includes:

(a) Frequency correction channel (FCCH), which is used to allow a MS to accurately tune to a base transceiver station (BTS). It is required for the correct operation of the radio system.

(b) The Synchronization channel (SCH), which is used to provide time division multiple access (TDMA) frame oriented synchronization data to a MS. This is also required for the correct operation of the mobile. (Jyri, 2008).

Thus any interference or break in the broadcast control channel (downlink) will render the mobile station incommunicado. This break can be as a result of weak signals due to proximity to the BTS, provided there is no handover, due to fading along the wireless channel and it could be due to high levels of interference which creates a dead-zone in such a region. Fig. 2 shows the GSM logical channels. The common factors that affect cellular reception likewise jamming include: strength and location of the cellular base station or tower, terrain and topology, weather and climatic conditions, structures, building material and construction methods. As noise is everywhere in different forms, frequencies and amplitudes, it is possible to extract noise from the environment using microphones. This research utilizes man-made or extrinsic noise as an interference signal. Since the downlink appears to be the weak link of this communication system, a dead zone is created by transmitting the jamming radio frequency signals on the downlink so as to interfere with the wireless channel at a level that cannot be compensated by the cellular technology.

The objective of the research work is to achieve complete network disruption on GSM 935-960 MHz and DCS 1805-1880 MHz with an effective jamming radius of approximately 10 meters while it aimed to investigate the elimination of phone activity disturbances in university community using the mobile phone Jammer.

MATERIALS AND METHODS

A noise generator is a circuit that produces electrical noise (a random non-deterministic signal). Noise generators are used to test signals for measuring noise figure, frequency response, and other parameters, it can also be used for the generation of random numbers. Several noise generation methods include: heated resistors, zener diodes and gas discharge tubes. In common jammer designs, such as GSM 900 Jammer by Ahmad, J. (2005), a Zener diode operating in avalanche mode served as the noise generator. When Zener diodes are operated in reverse bias at a particular voltage level, they go into avalanche mode which results into a random current flow and hence a noisy signal. Extrinsic (man-made) noise is a readily available resource in every community (Alice, 1991). In this project, extrinsic noise is mixed with such noise to create a signal with a higher noise signature. This extrinsic noise is tapped from the environment with the use of a high sensitivity microphone at -40 ± 3dB (0dB=1V/Pa,1KHz), placed in front of the jammer for better exposure to noise; with more microphones, a spatial diversity setting would be preferred. Fig. 6(b)-(c) shows the two noise sources under oscilloscope view. Extrinsic noise is random and unpredictable; the zener diode noise serves the noise requirement when jammer is used in a silent environment. The RFT has a VCXO which is tuned by an input ramp voltage. This generates RF signal with frequency in the range of 935-960 MHz for GSM 900 and 1805-1880 MHz for DCS as shown in Fig. 1. The RF interference signal is then amplified to a power of 20mW and transmitted via an omni-directional antenna. Fig. 3. shows the block diagram of the mobile phone jammer.

A Digital oscilloscope capable of analyzing signals up to 30MHz was used to measure and analyze output waveforms at the intermediate frequency unit. Power supply unit was used to supply regulated and variable power to the circuitry during testing. A digital multimeter was used to measure resistance, capacitance, current and voltage levels as well performing continuity test on the circuit board. A blackberry phone (blackberry curve

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9300) was used as the target mobile station for the jammer.

Fig. 6(a) shows the laboratory desk during testing operations. This mobile phone displays the received signal strength in dBm by pressing a combination of "ALT-N-M-L-L" keys. Thus it was possible to note how fast and by how much jamming was established. Livewire simulator package was used for some circuit simulation tasks. Each passive component was tested and value verified with respect to circuit diagram and available datasheet and this was done with the aid of the multimeter. Using laboratory breadboard, a prototype circuit was built and then transferred to a permanent Vero-board circuit. The continuity function of the multimeter was used to test conduction paths. The output of each circuit section was tested with the oscilloscope; clean probes were used and the time and voltage divisions were properly set to ensure the required output signal was visible and measureable. Noise circuit was tested while the laboratory fan was operational and students were having discussions.

The complete circuit of the jammer was switched ON and a blackberry mobile phone BB9300 was used to test the jamming effect. It was observed that the signal bars decreased and eventually went off. After few seconds, the mobile phone's cellular reception signal appeared as "searching for network" or "SOS". Range of the jammer was found to be around 10 meters in indoor conditions. Fig. 7(a)-(c) shows a jammed blackberry phone.

FIGURES AND GRAPHS

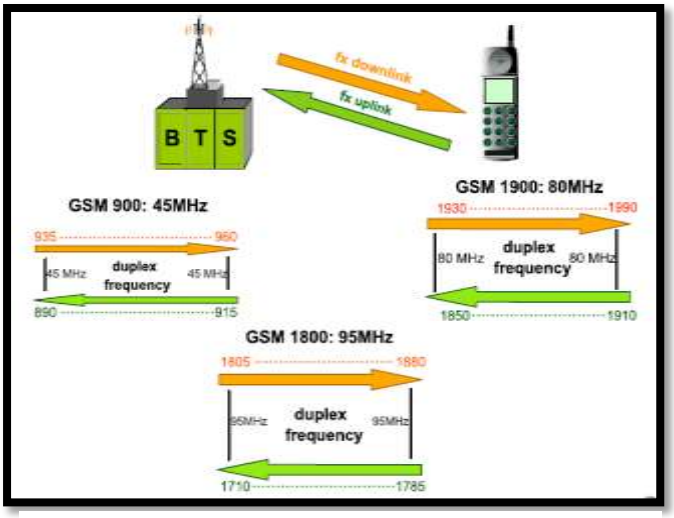

Fig.1. GSM FDD structure

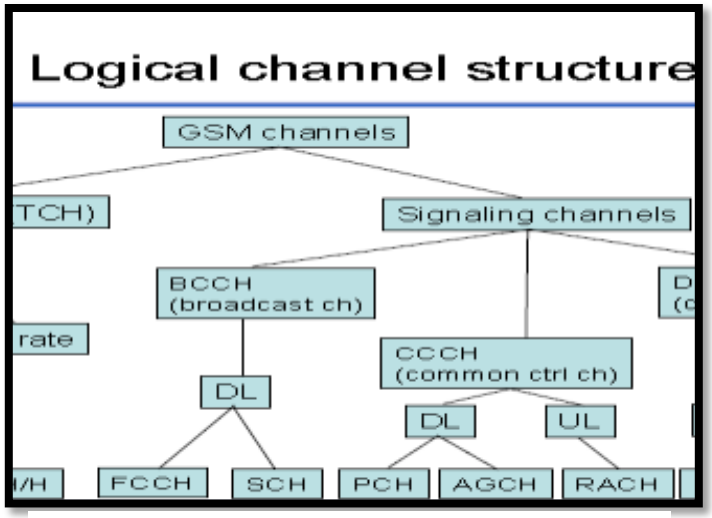

Fig.2. GSM Logical Channels

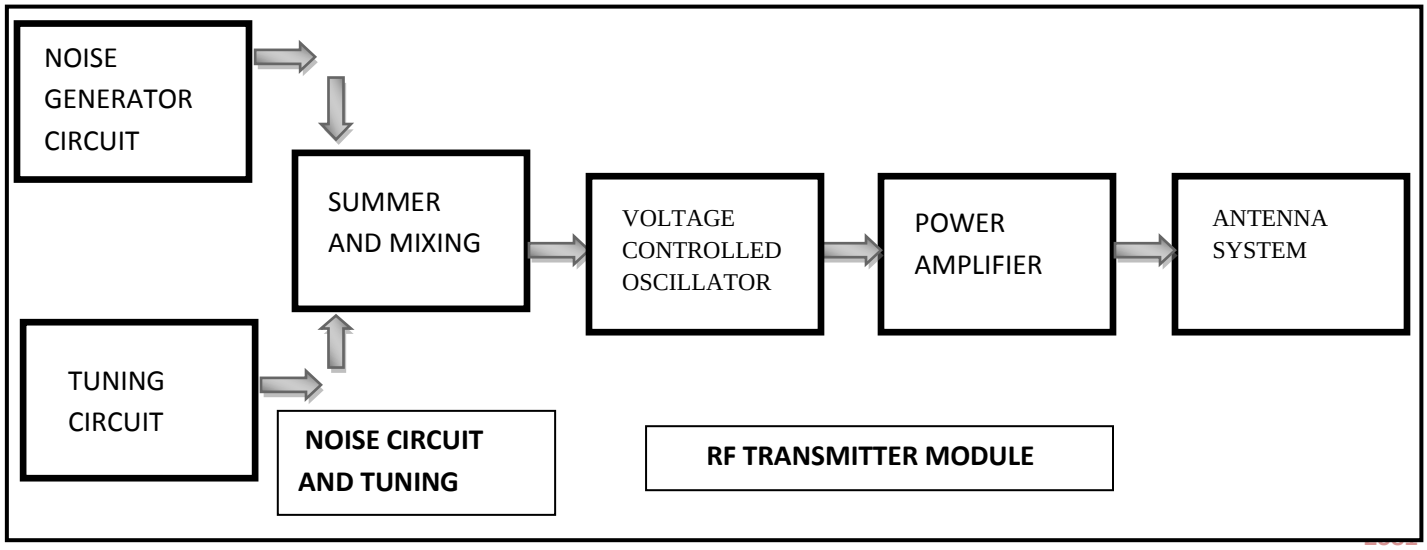

Fig. 3. Block diagram of Mobile phone jammer

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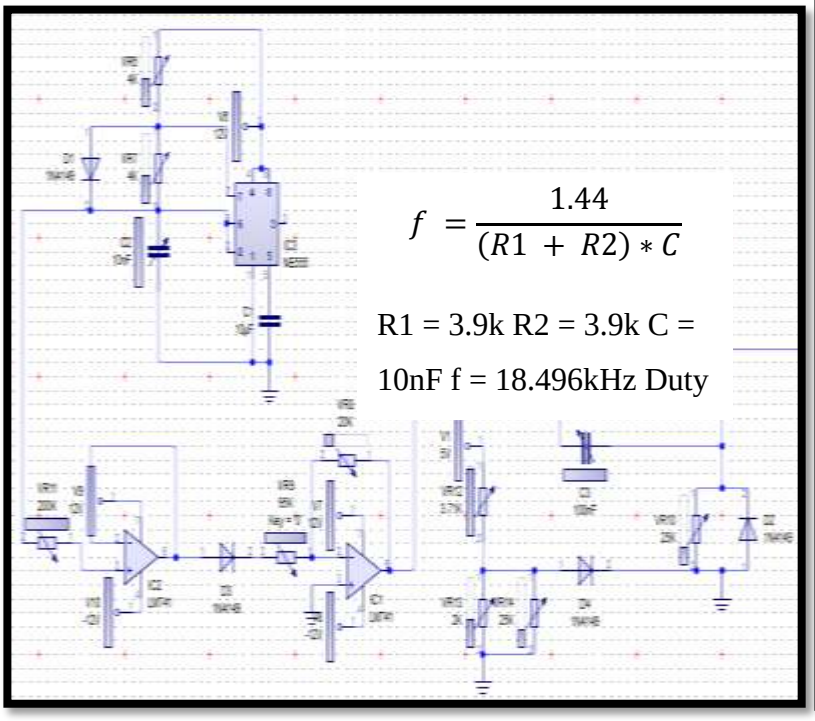


Fig. 4(a). Intermediate frequency circuit

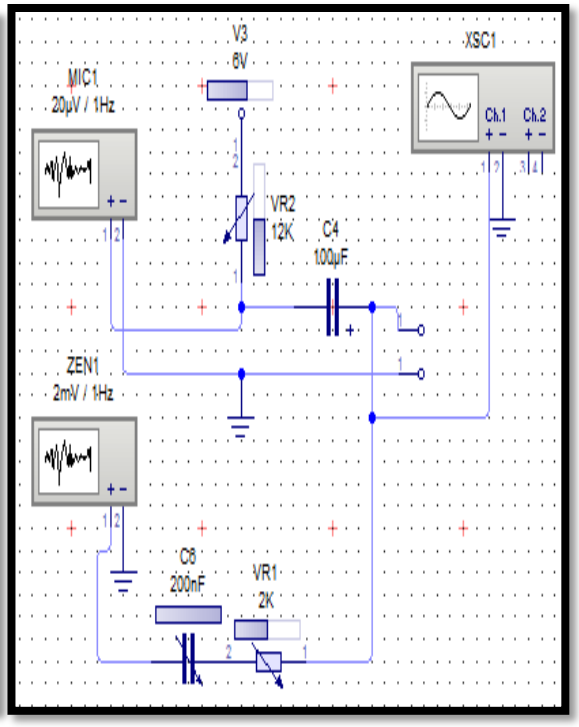


Fig. 4(b). Noise circuit diagram

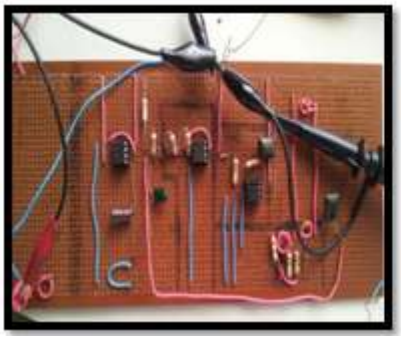


Fig. 5(a). Intermediate frequency module

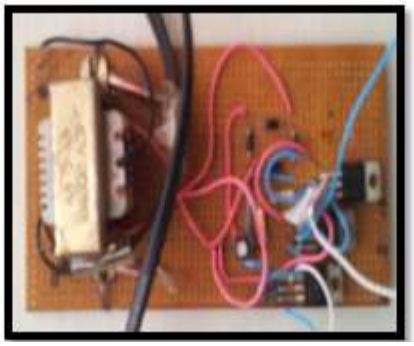
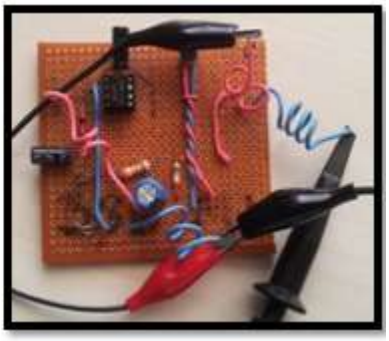


Fig. 5(b) Power module Fig.



5(c) Noise Circuits

Fig. 6(a). Laboratory Setup

Fig. 6(b). Extrinsic noise

Fig. 6(c). Zener Noise

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Fig. 7(a). BB-9300: Low signal

Fig. 7(b). BB-9300: No network

Fig. 7(c) BB-9300: "SOS"

RESULT AND DISCUSSION

The alarming rate of the use of mobile phones during lecture hours can easily be pointed out as one of the factors affecting student's academic performance in various institutions. So also, the techniques which students use in various forms of examination malpractices by which mobile phones are employed need to be curtailed. Using mobile phones during lecture hours can no doubt be pointed as a serious threat to the academic sojourn of today's youth. Students in universities cannot be said to be ignorant or oblivious of the harm imposed by digital-device-induced-distractions (DDiD).

There is barely any student on campus without a mobile phone. Apart from mobile phones, students are also endowed with other digital devices such as laptops, tablets, iPods and the likes. Although we are in a digital age and information processing is at advanced stages, experience has shown that some students have misused the opportunity presented by the new age technology either due to ignorance or a lackadaisical attitude. The prevalence of "Blackberry" mobile phones aids communication with relatives far and wide at relatively cheap rates. Telecommunications service providers make use of a BIS Server integrated into the telecommunication system and as such provide a robust social networking platform. At the rate of one thousand naira only (N1,000), a student can have monthly access to internet and other social media such as facebook, twitter, blackberry messenger (BBM), instagram, 2go, nimbuzz, whatsapp, badoo, chatOn, yahoo messenger, windows messenger and so on. A recent survey at the university including one hundred (100) students showed that the most used social media applications is "BBM" and "Facebook". It also concluded that the cellular network performance on campus is poor.

A test was carried out to investigate the performance of the mobile phone jammer in mitigating mobile phone activities on campus. This test was carried out randomly over a period of one semester (four, 4 months) at various locations in the university complex namely: EEE201,EEE301, EEE405 MCB201, GNS101 Lecture halls, Cafeteria, EEE lab, ICH lab and Co-operative hall. The first half (Phase 1) of the semester was used to record mobile phone activities without the jammer, while the other half (Phase 2) of the semester was used to record mobile phone activity with the mobile phone jammer activated at the respective locations and similar periods. 400 phones were involved and there were 343 cases of mobile phone activities recorded over Phase 1. Out of this, 136 cases in which there were phone call activities (circuit connection) by students without activation of the mobile phone jammer. With the mobile phone jammer, only four cases were recorded. So also,

207 cases in which there were messaging activities either through SMS messaging centre or social media such as "BBM" (packet connection) without activation of mobile phone jammer. With the activation of the jammer, only four cases were recorded in which the mobile phone jammer failed to prevent messaging activity. In total, there were a combined 8 cases of mobile phone activities with the jammer activated compared to initial 343 cases of combined mobile phone activities.

Table 1.0 shows the statistical distribution of cases and their respective scenarios while fig8.0 and fig. 9.0: respectively indicate Phone call activities with/without mobile phone jammer and text messaging activities with/without jammer.

Table 1.0: Statistical distribution of mobile phone activities with and without jammer

SAMPLES A	NS	**NP**	NCO	NCI	**TNC**	NCOJ	NCIJ	**TNCJ**	NTO	NTI	**TNT**	NTOJ	NTIJ	**TNTJ**
OUT	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
LECTURE HALL 1 (EEE201)	30	**30**	6	2	**8**	0	0	**0**	8	6	**14**	0	0	**0**
LECTURE HALL 2 (EEE301)	32	**32**	5	2	**7**	0	0	**0**	11	7	**18**	0	0	**0**
LECTURE HALL 3 (EEE405)	28	**28**	1	2	**3**	0	0	**0**	5	7	**12**	0	0	**0**
LECTUREHALL 4(MCB201)	47	**47**	9	4	**13**	0	0	**0**	13	11	**24**	1	0	**1**
LECTURE HALL 5(GNS101)	58	**58**	13	9	**22**	0	1	**1**	14	11	**25**	1	0	**1**
CAFETERIA	39	**35**	14	16	**30**	0	0	**0**	16	12	**28**	1	0	**1**
EEE LABORATORY	27	**27**	7	3	**10**	0	0	**0**	8	10	**18**	0	0	**0**
ICH LABORATORY	33	**33**	8	4	**12**	0	0	**0**	10	5	**15**	0	0	**0**
COPERATIVE HALL	112	**110**	20	11	**31**	1	2	**3**	31	22	**53**	1	0	**1**
	406	**400**			**136**			**4**			**207**			**4**

Key

NS - Number of students involved

NP - Number of phones involved

NCO - Number of cases of calls - out (Initiated calls) without Jammer

NCI - Number of cases of calls - in (Received calls) without Jammer

NCOJ - NCO with Jammer On

NCIJ - NCI with Jammer On

NTO - Number of text - out (Initiated texts) without Jammer

NTI - Number of text - in (Received texts) without Jammer

NTOJ - NTO with Jammer On

NTIJ - NTIJ with Jammer On

TNC - total no of calls

TNT - total no of texts

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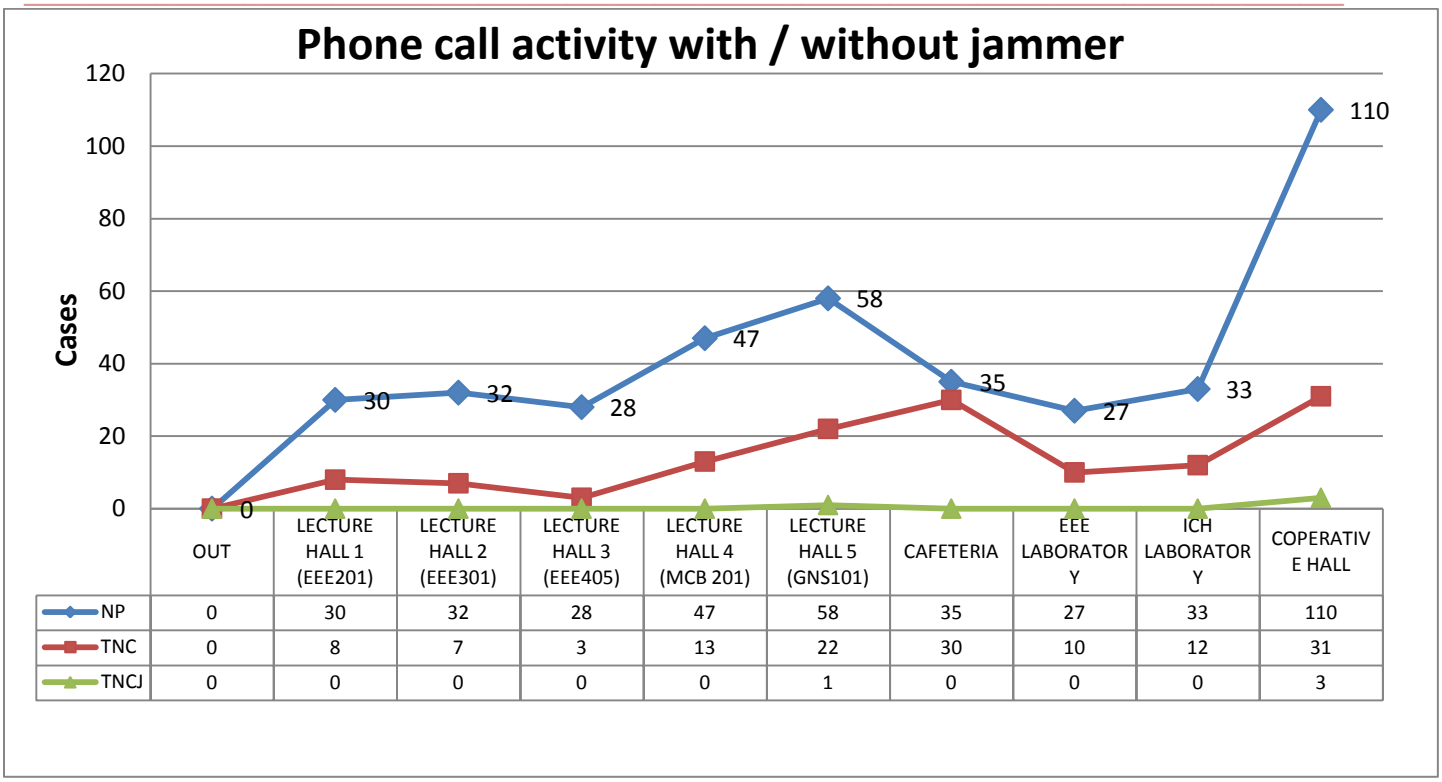
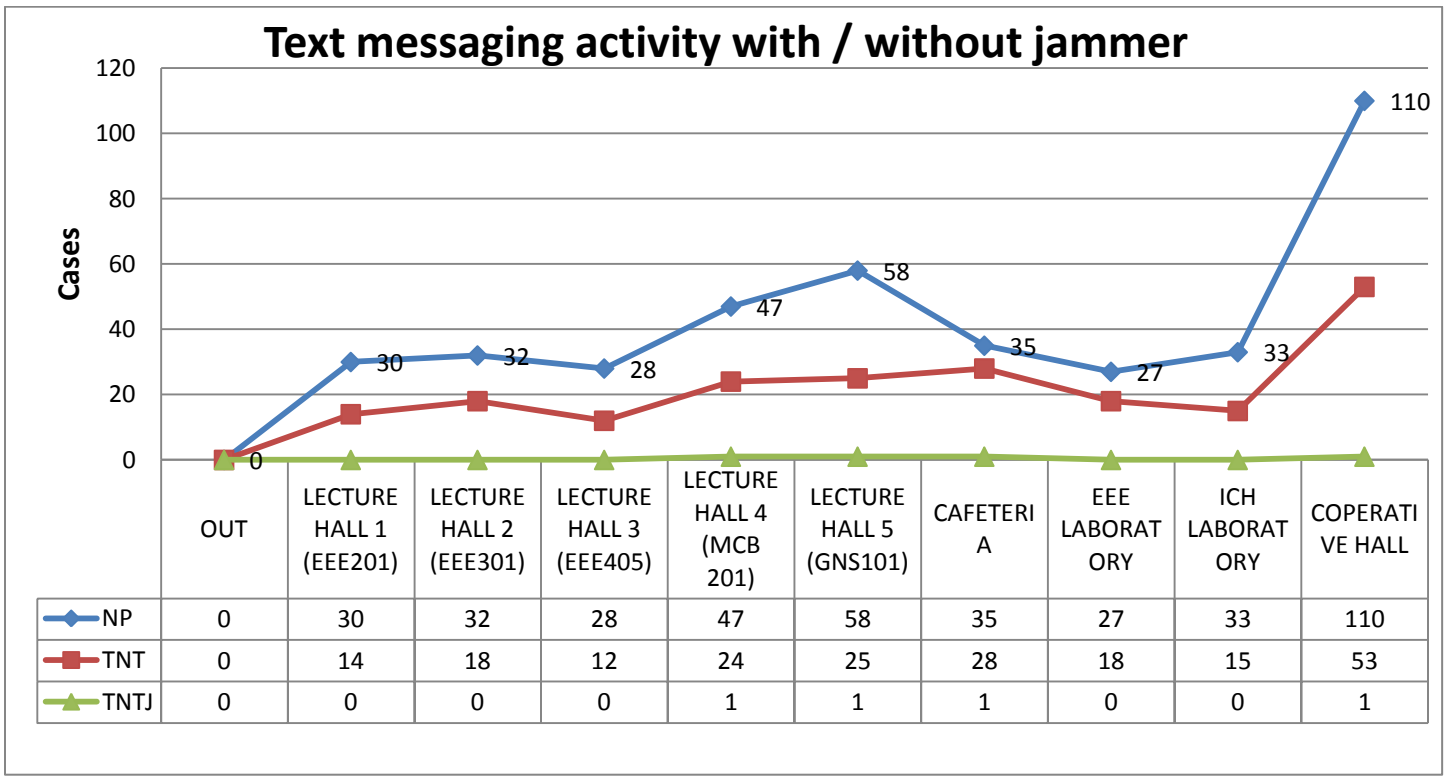


	OUT	LECTURE HALL 1 (EEE201)	LECTURE HALL 2 (EEE301)	LECTURE HALL 3 (EEE405)	LECTURE HALL 4 (MCB 201)	LECTURE HALL 5 (GNS101)	CAFETERIA	EEE LABORATORY	ICH LABORATORY	COPERATIVE HALL
NP	0	30	32	28	47	58	35	27	33	110
TNC	0	8	7	3	13	22	30	10	12	31
TNCJ	0	0	0	0	0	1	0	0	0	3

Fig. 8.0: Phone call activity with/without mobile phone jammer.



	OUT	LECTURE HALL 1 (EEE201)	LECTURE HALL 2 (EEE301)	LECTURE HALL 3 (EEE405)	LECTURE HALL 4 (MCB 201)	LECTURE HALL 5 (GNS101)	CAFETERIA	EEE LABORATORY	ICH LABORATORY	COPERATIVE HALL
NP	0	30	32	28	47	58	35	27	33	110
TNT	0	14	18	12	24	25	28	18	15	53
TNTJ	0	0	0	0	1	1	1	0	0	1

Fig. 9.0: Text messaging activities with/without jammer.

CONCLUSION

Jamming is an intentional way of using interference to one advantage(s) to block or impair communication within intends area at a period. From the result of the research, it can be concluded that a locally constructed mobile phone jammer of a small effective radius of 10m can be used to improve audience in the University environment or other noise sensitive areas. Denial-of-mobile *service (dos) using* extrinsic noise employed in the research is temporary and lasts as long as the jammer is on. The jammer did not completely suspend all the phone activities but considerably reduced it to barest minima. The effectiveness of the jammer can however be improved be increase its effective radius.

Communication between mobile stations can serve as a means of detonating improvised explosive devices (IEDs), a technique that is applied by both veteran and amateur terrorists and this is a major threat to life and property as experienced worldwide. Since a mobile phone jammer proves an effective way of blocking the radio air-interface, Jammers are useful in the following: university lecture rooms, libraries, concert halls, meeting room, police stations, military, VIP protection, private users or secure rooms, convoy jammers, facility jamming, checkpoints, perimeter borders, anti-terror, prison solutions, board rooms, examination halls, auditoriums, mosques, churches, embassies, court rooms.

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