

A New Exam Cheating Shielding Instrument

Gang Li, Lisha Gao

Tianjin Key Laboratory of Information Sensing and Intelligent Control, Tianjin University of Technology and Education, Tianjin, 300222, China

Abstract: This article has designed a instrument that based on swept interference to shield the communication of cheating device in examinations. The shield device using RC bridge-type oscillator to generate a sine wave ,by varying its oscillation frequency, integrated voltage controlled oscillator LC resonant circuit produce raw vibration, signal multiplier circuits to achieve frequency multiplication, varactor and microprocessor control relay to complete the change of frequency ,with a wide range sweep, sweep control accurate. The device has many characteristics such as a simple structure, easy to use and precise control , so one person cheats at any time or any band can't receive full cheating information. It achieves the purpose to interference of wireless communications.

Keywords: swept interference, shield device, microprocessor

1. Introduction

With the constantly updated of electronic communications equipment, it has been common to use electronic communications equipment to cheat in the examinations. The information sent from the new electronic cheating devices spread faster and faster , so it is difficult to track and capture the instrument . At present, there are some countermeasures for the wireless communication: monitoring direction finding location method and interference suppression method. Monitoring and direction finding positioning method, that is to say monitoring of unknown signals in a specific area of the examination room. Once found cheating signals, namely, position and direction, for in the shortest possible time to investigate found cheating signal source and stop cheating; Interference suppression method, that is, in the effective coverage area of the examination room, set up a high power radio frequency interference signal source, blocking the the radio receiver in examination room , to prevent the purpose of cheating. In this paper, the design of the new test cheating shielding device, take the initiative method to attack, by means of sweeping over the whole frequency band and the principle of strong signal coverage weak signal to interfere wireless communication equipment . Therefore, in any arbitrary time or any frequency band, no matter whether the information received is sound or picture, cheaters can not accept the full information of cheating. The key technology of the design is to use the interference suppression technique and the wide band technology principle to carry on the entire radio frequency spectrum scanning, simultaneously transmit the interference signal in multiple frequency band.

2. The Basic Principle of Exam Cheating Shielding Instrument

The basic idea of the design is to divide the 0.3MHz~2.4GHz radio frequency spectrum into several frequency bands, and make the signal transmission circuit of multiple units, each unit of the frequency band interference emission circuit in accordance with a certain period of time in the frequency band of the periodic scanning frequency, and then the interference signal is transmitted into the air. The fundamentals of exam cheating shielding instrument is emitting a certain range of electromagnetic signals within a

frequency band. The spectrum of the electromagnetic wave signal covers all electromagnetic wave signal frequency of cheating devices. Since the electromagnetic wave sending from shielding instrument is much stronger than cheating devices and they are the same frequency, interfering base station to receive the information emitted by the cheating device, so that the cheating device does not recognize interfering electromagnetic and useful electromagnetic waves. Therefore, cheaters can't receive complete cheating information.

3. The Design of Hardware Circuit

Exam cheating shielding instrument is mainly composed of LC signal generator, high-frequency circuit, multiplier circuit, power amplifier circuit, MCU control circuit and a power circuit. Its working principle structure diagram is shown in Figure 1.

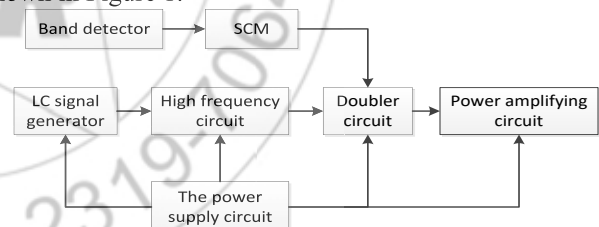


Figure.1: Structure block diagram of exam cheating shielding instrument

3.1 The sine wave signal generator

Sinusoidal signal generator using the RC bridge-type oscillator that composed of integrated operational amplifier 741, it can generate a frequency of several kilohertz sine wave signal. As shown in Figure 2, the output signal voltage U_0 is calculated by the bridge-type works. In the figure, resistor R and the capacitor C constitute a bridge-type arm, diode V1 and V2 that connected in parallel with W1 composed of a non-linear resistors. The resistor R1 ,the resistor R3 and adjustable resistance W1 between the output terminal and the inverting input terminal, which constitute a negative feedback and stabilize amplitude. When adjusting the W1, the output signal waveform can be stable, and the distortion is small. A2 is a noninverting amplifier, connected to the output of the oscillator, the sinusoidal signal is sent out by the A2 output point P1, adjusting the W2 can change the amplitude of the output

signal.

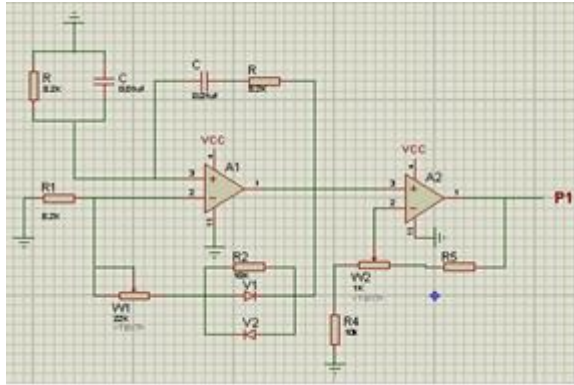


Figure 2: sine wave signal generator

3.2 High-frequency circuit

The effect of high-frequency circuit is using a high frequency voltage controlled oscillator principle, to make the local oscillator of frequency KHz into a high frequency signal of frequency MHz. High-frequency circuit is shown in Figure 3, with a control signal voltage controlled oscillator for a selected period, the control signal is a sine wave, from the P1 port input. Variable capacitance diode V3, capacitance C4 and inductance L constitute oscillators LC. When the voltage of variable capacitance diode V3 change, causing a change in capacitance, a change in capacitance of diode V3, resulting in changes in the frequency of the sine wave. In the figure through the single chip microcomputer to change the the access of inductance L1, L2, L3, you can generate a wider range of sine wave. Q1 is a high frequency transmission about 1 watts, its main function is to amplify the weak interference signal and then send it to the power amplifier. VCC is a 12V DC power supply, P3 is the signal output.

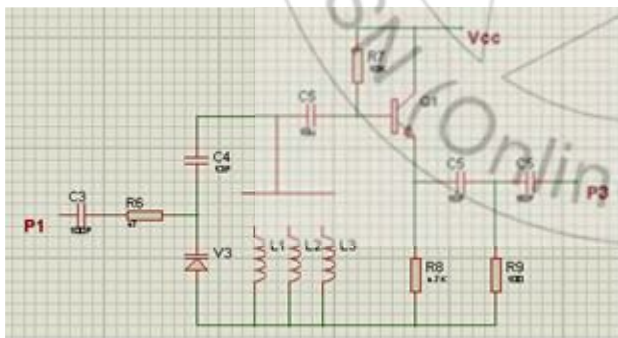


Figure 3: High-frequency circuit

3.3 Frequency multiplier circuit

Frequency multiplier circuit is to change the frequency of the interference wave, so that in a certain range of cycle to repeat, so as to achieve full-band interference. As shown in Figure 4, CD4046 and BCD addition counter CD4518 constitute a phase-locked loop frequency multiplier circuit. Phase-locked loop CD4046 is a RC type voltage controlled oscillator, external capacitor C14 and resistor R12 perform charging and discharging function. CD4518 is a two, decimal (8421 coded) synchronous plus counter. Signal f1 from the Ui input, after shaped and amplified by the amplifier then applied to the input terminal of phase comparator I, II, and then filtered by resistance R10, R11

and capacitor C13, the control voltage Ud is added to the input terminal 9 feet of voltage controlled oscillator VCO. By continuously adjusting the frequency f2 of VCO oscillating, so that the frequency of f2 approach the frequency of input signal f1, at last achieve phase locking. After the phase-locked, the frequency doubling signal is output from the Uo.

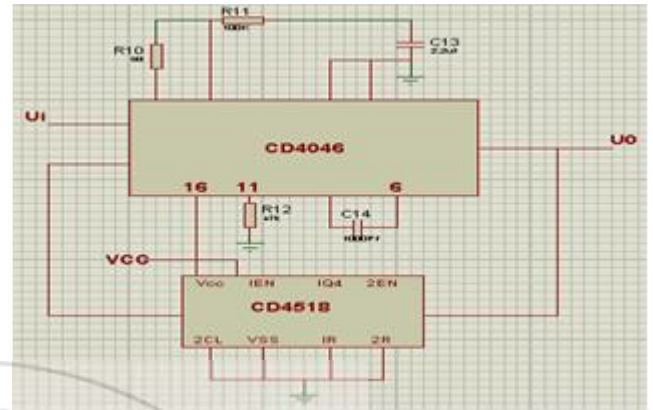


Figure 4: Frequency multiplier circuit

3.4 The power amplifying circuit

The function of the power amplifying circuit is to improve the signal transmit power, and make the signal intensity exceed the signal that the examination cheating device sends out, so as to achieve the function of jamming the cheat signal. As shown in Figure 5 is a resonant circuit of the power amplifier, the inductance L8 and capacitance C14, C15 produce resonance, capacitance C14 is used to adjust the input matching, capacitor C15 is used to adjust the resonance. The role of high-frequency choke L10 is to produce a small negative bias to the base. The collector adopts a parallel feedback circuit, L11 is a high frequency choke, C18 is a bypass capacitor. Inductance L9 and capacitance C16, C17 form an L-type output matching network. When adjusting capacitance C16 and C17, the external load R11 can be converted to the matching resistance required by the amplifier at the operating frequency.

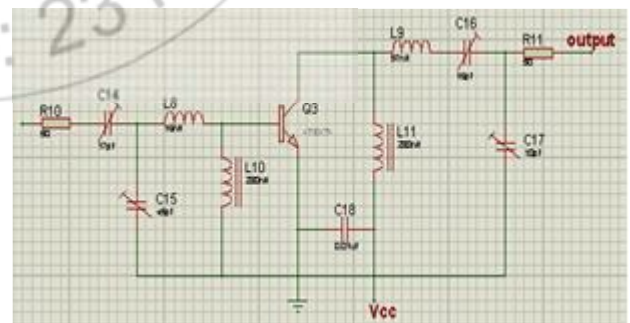


Figure 5: The power amplifier circuit

3.5 Single chip microcomputer control circuit

Figure 6 is a single-chip microcomputer control relay driver circuit, relay RL1 and RL2 control three inductors, so that the voltage controlled oscillator to generate different local oscillator signal, and then output the electromagnetic interference wave of different frequency bands, jamming the examination cheating information in a wide range. As shown in Figure 6, the model of single chip is AT89C52. One of the control circuit is derived from the port P2.1, and the other

group is derived from the port P2.2. One end of the relay is connected to the collector of the transistor, and the other end is connected with the power supply. The relay and the diode are connected in parallel, which is used for absorbing and releasing the reverse voltage of the relay coil when the power is cut off, preventing the reverse voltage from breakdown of the transistor and interfering with other circuits.

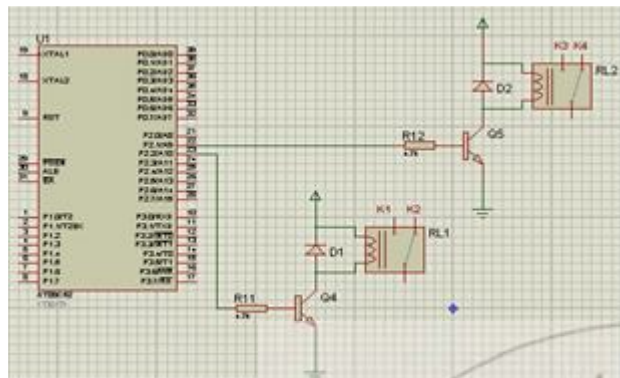


Figure 6: Single chip microcomputer control circuit

3.6 Single chip computer program flow

The main program of system controls the single chip microcomputer to drive the relay to close, through the relay switch control to realize the function of the required inductance. When the port P2.1 input low, the normally open contact of relay closure and access to the inductance L1. When the port P2.1 access to high power, the relay normally open contact release and access inductance L2. When the port P2.2 input low power, the relay normally open contact closure, access inductance L3. This is the process of a single chip microcomputer to select the inductance.

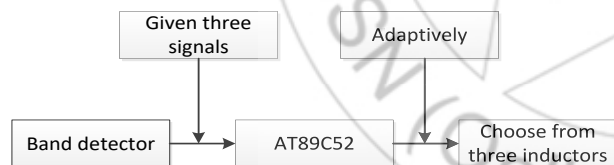


Figure 7: Working flow chart of single chip microcomputer system

4. Summary

In summary, the method of examinations cheating shielding instrument designed in this paper is simple. In each examination room placed one, can achieve the effect of shielding the wireless communication equipment to send information. The shielding instrument is adopted in the high frequency circuit by a single chip microcomputer controlled relay, which increases the range of the inductance can be selected, thereby increasing the shock frequency, making the sweep frequency range increased, so as to achieve full spectrum scanning. Its technology is characterized by the use of interference suppression technology and broadband technology principle of all radio frequency spectrum scanning, in a plurality of frequency bands periodically scan each frequency point and synchronous transmission of interference signals. The utility model has the advantages that a plurality of frequency bands can be carried out in the

synchronous scanning transmission interference signal, thus the scan all of the radio spectrum is very short period, avoiding the wireless communication device in multiple frequency point transmitting information cheating, which effectively interfere the cheaters to useful information reception

References

- [1] Ningbo Hu, Jian Wang, Yan Han. Design of anti cheating interference device for examination room [J]. Computer measurement and control, 2012,20 (002): 520-522.
- [2] Yali Wang, Xinqun Sun. Discussion on digital signal interference effect of cheating [J]. China radio, 2010,09: 66-67.
- [3] Weiguang Zhang, Liyan Zhang, Xuegang Wang . Research on active defense sweep frequency band wireless test room anti cheating interference equipment.[J] Journal of natural science, Harbin Normal University, 2010,01 (26) 68-70
- [4] Kai Wang. SMS transmitter cheating case analysis and Counter measures[J] Chinawireless power. 2009,06:56-59.
- [5] Yan Feng, Jian Chu. Design of full band test cheating jamming device[J]. electronic technology and software engineering, 2013,14: 21.
- [6] Shuyong Xu, Haiyong Wang, Yunfeng Tang. Design and implementation of frequency synthesizer based on ADF4350 phase locked frequency synthesizer [J]. Electronic device. 2010,06:725-729.
- [7] Congwen Zhu, Minglin Sun, Zhengbin Hu. Tracking the latest cheats to effectively combat cheating on the exam [J]. China Radio, 2014,01:49-53.
- [8] Feiyan Zhang. Radio interference suppression technology [J]. China Radio, 2015,12:60-61.
- [9] Bin Jian. The realization method of anti cheating in examination system [J]. Electronic technology and software engineering, 2014.
- [10] Shibai Tong, Chengying Hua. Simulation of electronic technology foundation [M]. Beijing: Higher Education Press, 2001.
- [11] Yanru Hu, Suyan Geng. The high frequency electronic circuit [M]. Beijing: Higher Education Press, 2008.
- [12] Richard A. Poisel. Modern communication jamming principle and techniques[M] Electronic industry press, 2005
- [13] Junli Zheng, Qihang Ying, Weili Yang. Signal and system [M]. Beijing: Higher Education Press, 2000
- [14] Sumin Jiao. Foundation of digital electronic technology (Second Edition) [M]. Beijing: People's Posts and Telecommunications Press, 2012.