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Design of Communication AM Transmitter

Zirui Zhao*, Shuyao Wu, Zekai Wang

Department of Electrical and Information, Jinan Campus, Shandong University of Science and Technology, Jinan, Shandong, 250031, China
**Corresponding author: 519277522@qq.com*

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Abstract: This paper designs the wireless am transmitting system, designs the circuit of each module under the system, processes the corresponding design results, carries out the design simulation through Multisim, and explains the circuit principle. After the signal is input, the electromagnetic signal to be transmitted can be obtained by processing the incoming audio or video signal through each module.

1. Introduction

With the advent of 5g era, wireless communication has made a key breakthrough in technology, and is also applied in various scenarios. FM receiver is one of the most common ways of signal receiving module in communication system. In this paper, a wireless AM transmitter is designed to transmit audio or video signals by changing the amplitude of the signal without changing the signal frequency. A good wireless AM transmitter system can more truly reflect the information transmitted by audio or video signals, so the research on infinite AM transmitter is very important.

2. Scheme Design of Wireless AM Transmitter

This design is mainly divided into two parts: modulator and high frequency power amplifier. The whole system framework is shown in Figure 1. The system mainly converts audio or video signals into electromagnetic signals and transmits them to space, which is conducive to receiving by receiving equipment [1]. The specific principle is as follows: when the low-frequency signal enters the transmitting equipment, the baseband signal is converted into a modulated signal suitable for transmission in the channel through modulation. During modulation, a high-frequency oscillation signal (carrier) is also required to achieve the purpose of amplitude modulation. If the frequency of the modulated signal is not enough, a frequency converter needs to be added after the modulator. If the amplitude of the modulated signal is not enough, excitation amplification needs to be added to achieve the required amplitude. Finally, other useless signals are suppressed by high-frequency power amplifier, and the modulated signal is amplified to achieve the required power. In this design, due to the use of MC1496 integrated chip, the design of frequency converter, carrier oscillator and excitation amplification module is omitted

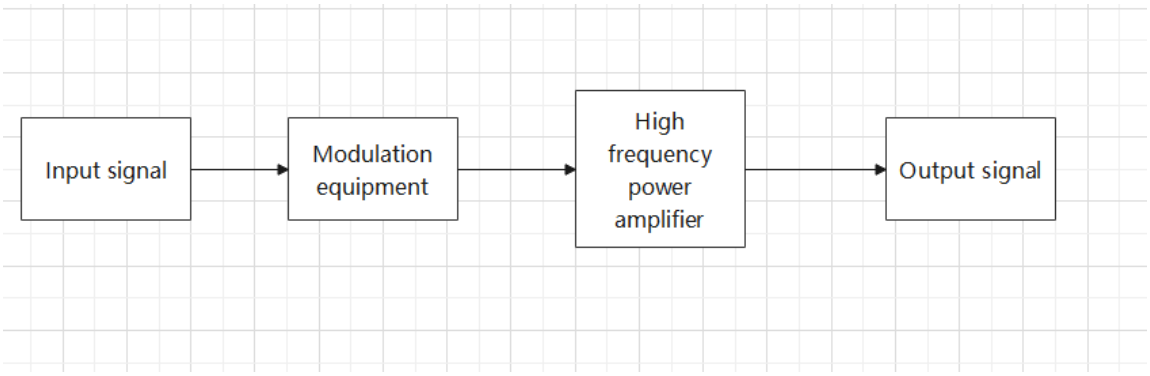

Fig.1 Overall Design of Receiver.

3. Design of Each Module

3.1 Modulator

Modulation is the process of using the input modulation signal to control a certain parameter of the carrier generated by the local oscillator. AMplitude modulation is the process of using modulation signal to control the change of carrier amplitude, so that the carrier amplitude changes according to the law of modulation signal, while other parameters do not change.

In this module, MC1496 chip is used to realize the function of this module[2]. The chip is an integrated chip, which can realize the function of multiplying two quantities. In high-frequency electronic circuits, the process of checking waveform, mixing, frequency doubling, modulation and demodulation can be regarded as the process of multiplying two signals. Compared with realizing the functions of each module step by step, the use of integrated chip can greatly reduce the cost, and the operation is simple and relatively simple. Figure 2 shows the design of MC1496:[3-4]

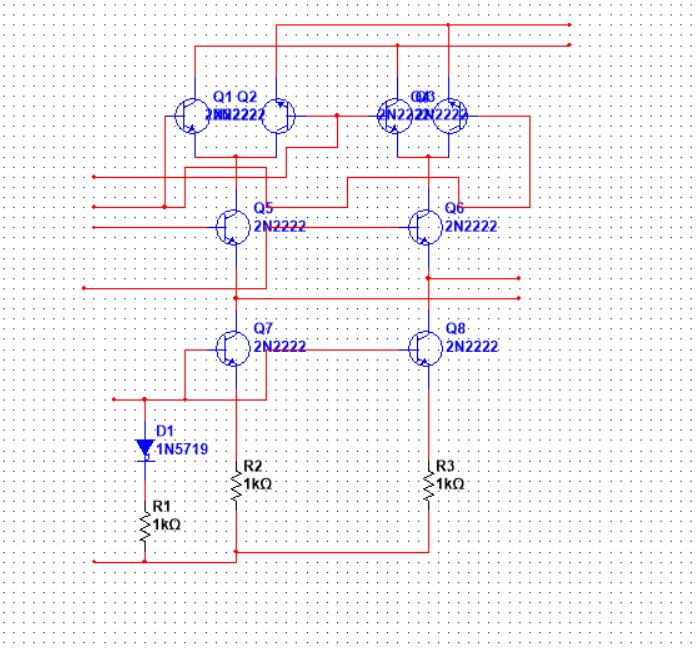

Fig.2 Design of Mc1496

For the chip, the dual power supply mode is adopted to ensure that each transistor in the device works in the amplification state. The function of amplitude modulation can be realized by expanding the external pins. The specific circuit is shown in Figure 3[3-4]

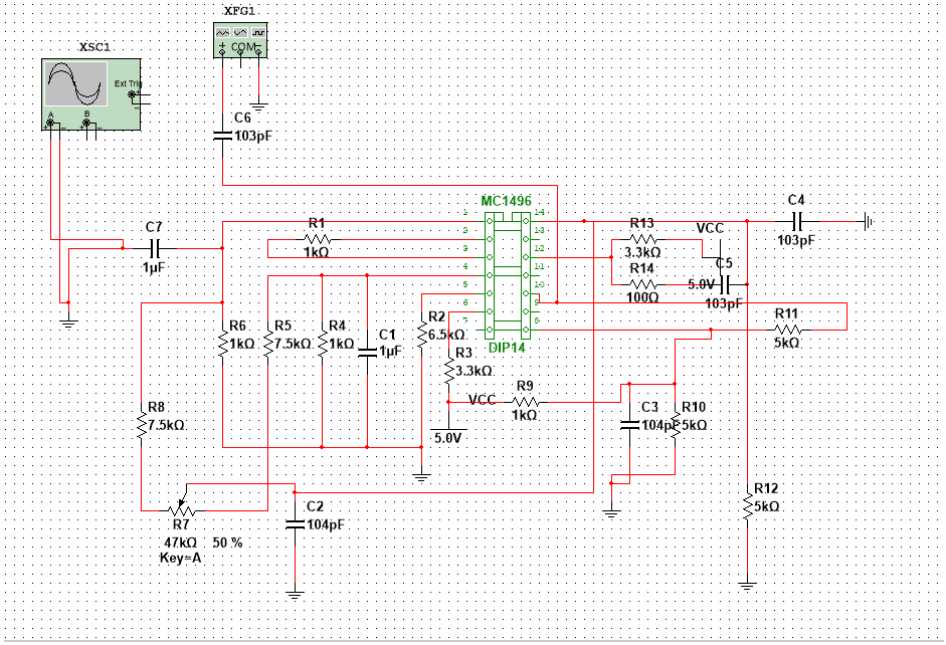

Fig.3 Design of Mc1496

It should be noted here that the static working point should satisfy the following relationship during application

$$v8 = v10, v1 = v4, v6 = v12 \quad (1)$$

$$15V \geq v6\ (v12) - v8\ (v10) \geq 2V \quad (2)$$

$$15V \geq v8\ (v10) - v1(v4) \geq 2V \quad (3)$$

$$15V \geq v1(v4) - v5 \geq 2V \quad (4)$$

3.2 High Frequency Power Amplifier

High frequency power amplifier according to its working state and current conduction angle θ The scope of can be divided into class A, class B, class C and class D. Class a power amplifier θ= ± 180o, efficiency η The maximum can only reach 25%, and the current conduction angle of class B power amplifier is 90 ° ≤ θ ≤ 180 °, the efficiency can reach 50%, and the current conduction angle of class C power amplifier θ ≤ 90o, the efficiency can reach 80%.[2]

Compared with the previous types of high-frequency power amplifiers, class AB high-frequency power amplifier can be said to be a combination of class a high-frequency power amplifier and class B high-frequency power amplifier. Class AB power amplifier circuit has two bias voltages. When the transmitted signal is small, select the working mode of class a high-frequency power amplifier to achieve the best effect. When the signal is higher than a certain frequency, select class B high-frequency power amplifier to work to achieve amplification optimization. Figure 4 is the design of class AB high frequency power amplifier circuit. Observe the sine wave waveform with an oscilloscope, and observe the change of sine signal amplitude by adjusting the sliding rheostat.

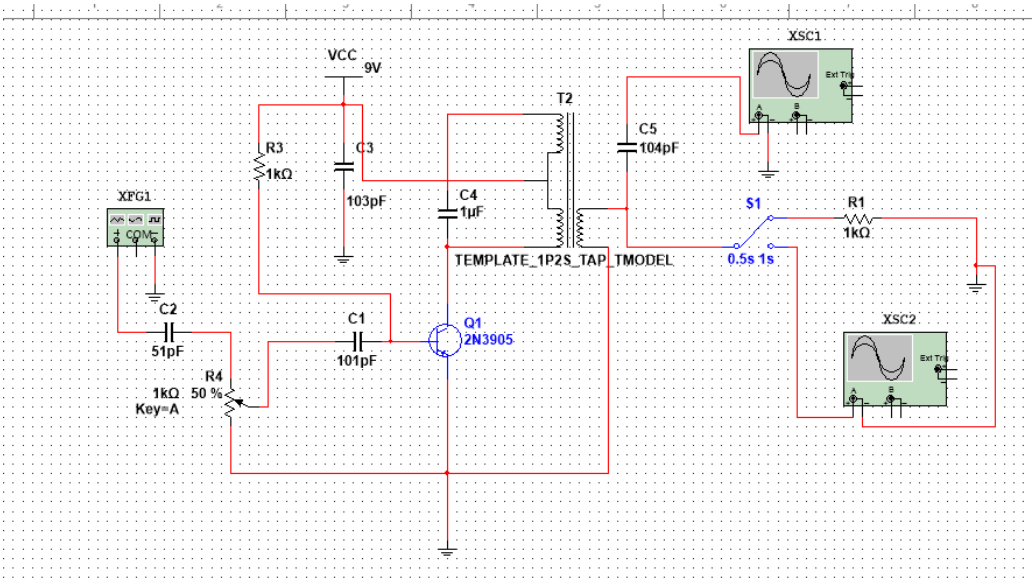

Fig.4 Circuit Design of High Frequency Power Amplifier

4. Conclusions

This paper gives a preliminary construction scheme for the wireless AM transmitter system and the design of each module of the system. The circuit of each module is simulated by Multisim, and some data are preliminarily simulated, but the operation is not given accurately. Therefore, there are still many places to be improved and waiting for later improvement

References

[1] Zeng Xingwen. Principle and analysis of high frequency circuit [M]. Xi'an: Xi'an University of Electronic Science and Technology Press, 2017.

[2] Xie Zimei. Experimental test of electronic circuit design (Third Edition) [M]. Wuhan: Huazhong University of Technology Press, 2006.

[3] Qu Baozhong, Zhang Jitao, Liu Yizhu. Circuit simulation analysis and design based on Multisim [J]. Journal of Henan University of Technology (NATURAL SCIENCE EDITION), 2009,28 (03): 329-332+336 DOI:10.16186/j.cnki. 1673-9787.2009.03.022.

[4] Wu Xinghong, Wang Mingqiu. Simulation and analysis of high frequency circuit based on Ni Multisim 10.0 [J]. Journal of Yunyang Teachers College, 2009,29 (03): 52-54.