

## Design of a TV audio wireless transmission system based on Bluetooth Technology

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### Abstract

**In this paper, the CSR low-power BC5-MM Bluetooth chip is used as the control core to design a television sound Bluetooth wireless transmission systems. The design process and hardware circuit is introduced. The system can transform TV audio output into Bluetooth signal by AD2 protocol. Since the convenience and stability of this design, users can enjoy music with high quality.**

### Keywords

**BC5-MM, Bluetooth transmitting, audio filter.**

### 1. Introduction

In nowadays television has become an essential entertainment tool in daily life. To avoid interrupting others, people wish to utilize an earphone to listen the audio in some place, such as the area where children to learn, or the old to rest. The shortest distance to watch TV is more than 3m, which implies that the wired earphone is not suitable in this situation. In this condition, TV audio wireless transmission system is of more advantages. Similar products have appeared in the market. Earlier products usually employ FM wireless transmission system. This system has its advantage but easy to be interrupted by harmonic wave and produces a new interference, at the same time, its mutual anti-jamming is poor, so it is not appreciate for large-scale application. As Bluetooth Technology emerges, its special advantage in wireless audio result in the appearance of more and more wireless Bluetooth earphones. However, the communication objects are almost phone and PC, rarely in use to receive TV audio signal directly. The content below in this paper will display a design of TV audio wireless transmission system based on Bluetooth Technology.

### 2. Overall design for the circuit

This system exploits CSR's BC5-MM Bluetooth module as main control chip, and contains external flash memory ROM. The bottom protocol of Bluetooth and the configuration parameters are stored in the form of firmware which is used as Bluetooth protocol stack. After being filtered by filtering circuit, TV audio signal is transmitted through differential transmit to BC5-MM Bluetooth module and then be processed. Antenna is arranged according to Bluetooth RF Class2 criterion and A2DP protocol. To acquire reliable connection in noisy environment, the balanced filter is applied to transmit 2.6GHz wireless HF Bluetooth signal. The system design sketch is shown in Fig. 1.

#### 2.1 Design of hardware circuit

The hardware part of this system mainly contains power management circuit, BC5-MM Bluetooth main control circuit, audio filtering circuit and Bluetooth signal transmitting circuit, etc. Only one LED displays is used to match the Display Circuit, and one button inputs is utilized to match Reset function. Because of the simplicity, the hardware will not be mentioned in this paper.

#### 2.2 Power management circuit(PMC) design

Since BC5-MM has built-in Low Dropout Linear Regulator (LDO), only external 3.3V voltage is needed. PMC will convert it to 1.5V core supply voltage and 1.8V I/O supply voltage, so the circuit

design is simplified. Considering the USB interface is widely used in home set-top box, so this PMC adopts USB to supply power, and the typical conversion chip of AMS1117-3.3v is selected. Besides, in order to use freely, 3.7V lithium battery is used as a backup power supply in design, and an USB battery charging circuit based on TP4054 management chip is fitted. The Power management circuit is shown in Fig.2.

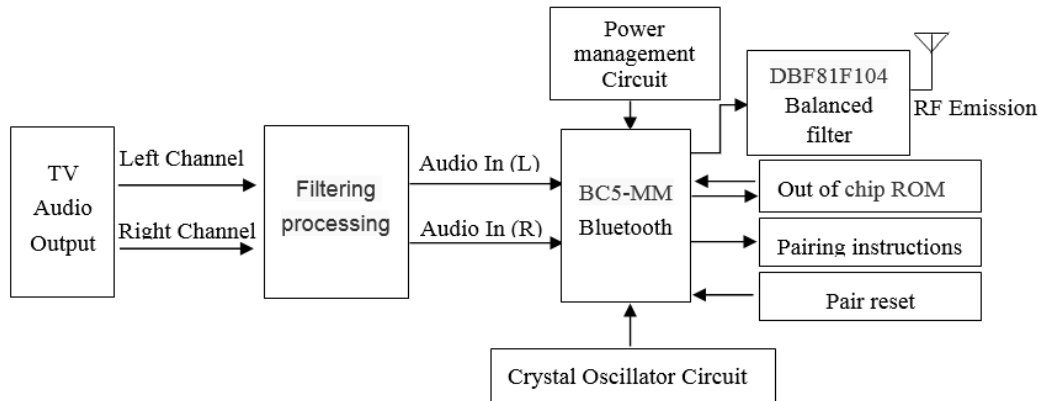


Fig.1 The overall design

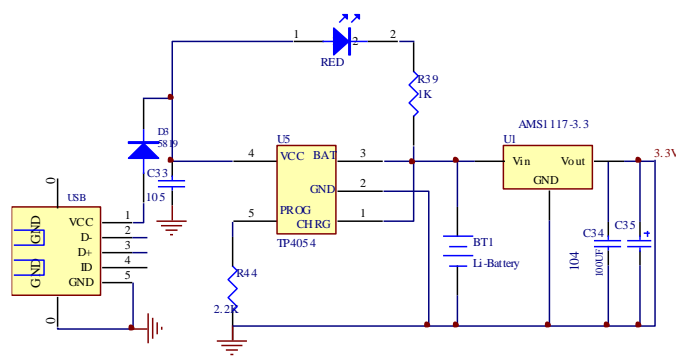


Fig2. Design of power management circuit

### 2.3 Audio filter circuit design

In order to get a better audio source quality, TV audio output signal must connect to audio filter circuit, as is shown in Fig.3. This system adopts the left and right channel audio differential input method (when input is single-ended signal, the input terminal can be connected by LINEIN\_L+ and LINEIN\_R+, LINEIN\_L- and LINEIN\_R- can be short connected to GND with jumper.). Capacitors of C6, C7, C11, C12 and resistors of R3, R6, R4, R7 form two RC filter circuit. The input signal's frequency can be sieved by setting parameters. The parameters also can be adjusted based on the condition of receiving loudspeaker or people's need. By analyzing the popular demand and multiple tests, author concludes that it is best when the resistor value is 1k ohm and the capacitor value 1uF.

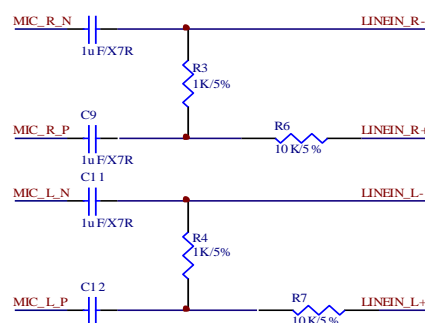


Fig.3 Audio filter circuit

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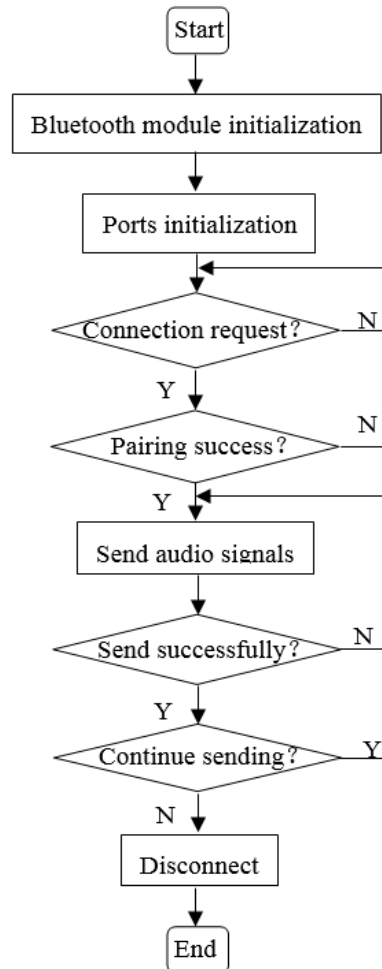


Fig.5 Programming design flow chart of sending of Bluetooth module data

## 2.6 Test result

By testing, the system can deal with high quality's stereo. The sample rate is as high as 44.1kHz. The RT Bluetooth emissive power is about 4dBm, and the transmission distance is about 10m without blocking. This system can connect to the Bluetooth earphones which satisfy A2DP protocol automatically without any drivers. LED function display tested is shown in Table.1.

Table.1 LED display function testing

No	Status	LED on (ms)	LED off (ms)
1	vacant (not connected)	1000	100
2	Searching and matching	100	100
3	connected	Stay on	none

This system is of very low radiation to bodies, and low power consumption. At the same time, it will not interfere with other Bluetooth devices. Along with widely use of Bluetooth technology, the price will reduce drastically. Although there is no special applications aimed at TV audio Bluetooth transmitting, this design may provide some experience in Bluetooth design, and has practical application value.

## References

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