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# DESIGN THE SYSTEM TO AUTOMATICALLY DETECT THE TYPE OF ANTENNA IN A CAR WITHOUT AFFECTING THE SYSTEM PERFORMANCE

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## ABSTRACT

The main objective of this paper is to analyze the type of antenna which is connected to the car and to provide the necessary action will be performed for the power supply unit. There will be a several decades to fit commercial vehicles and private cars with radios to receive national broadcast programs. The performance of these radios has now become more critical in view of the demand for high fidelity audio, the increasing number of local radio stations. Either Active Antenna or Passive Antenna will be connected with the car for FM Radio reception. The type of antenna will be detected by the current response of the device. This will be handled by the current sensing circuit which is in the main board and microcontroller in the front board. The corresponding information will be displayed in the display unit. All of these process will be handled in the Audio Head Unit (AHU).

**Key words**: Active antenna, Passive antenna, Current sensing circuit, Microcontroller, AHU.

## INTRODUCTION

It has been common practice for several decades to fit commercial vehicles and private cars with radios to receive national broadcast programs. The performance of these radios has now become more critical in view of the demand for high fidelity audio, the increasing number of local radio stations. The electrical performance of new types of car antennas, such as active window antennas make use of improved antenna structures; they profit from the progress in semiconductor technology and the dramatically reduced price of active elements: and they take advantage of much research done with respect to low noise

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and high linearity amplifier circuitry[1]. Generally, the typical problems in the design of modern car radio antennas are:

(1) Matching the antenna to the frequency range of 148 KHz to 1606.5 KHz (LW, MW) and the 49m – band (SW) for AM, TV for wide-frequency bands covering both VHF and UHF bands;

(2) Reduction of multipath fading in FM and TV broadcast reception; and

(3) Avoiding the reception of noise generated by the engine and electronic circuits installed in the car.

In general case, there will be some categories in the car depends upon the users requirement. There may be SUV's, MUV's and Hatch bag and Sedan cars. Depends upon it the usage of radio FM antenna will be differ[4]. And also, the placements of antenna also differ. Other than this FM radio antenna, there are antennas using for some other works. There may be internal antenna, External antenna, Satellite antennas, and Bluetooth antennas and especially for GPS purpose antennas are available. In this paper we are considering the FM radio antennas only for analyzing the performance with the power supply.

The FM radio antenna can be classified into two types. They are Active Antenna and Passive Antenna. In this paper, we are going to analyze and detect these two types of antenna.

Active Antenna contains active electronic components. The antenna size to wavelength mismatching problem can create the signal attenuation problem. It can be compensated by the active circuits. These active circuits consist of (a). Impedance Translating Stage and (b). Optional Amplification Stage. And these stages will be used in the receiver part, because these are unidirectional[7]. The Active antennas are working with the dedicated power supply. These power supplies will be given by the Batteries, Filtered Power supply or through the signal feeder. It will work with the voltage range of 9 to 12 v. The best example for the Active antenna will be the Windscreen antenna. There will be the Transformation network will be connected in between the Amplifier and Antenna for the better impedance matching. When we are using long length cable, there may be a chance for cable loss. For this instance, the active antennas are recommended. Active antennas are better choice for Military and Commercial applications.

The Passive antenna have the structure is a electrical conductor or array of conductors that radiates electromagnetic waves. These electromagnetic waves are also referred to as Radio waves. Most of these types of Passive antennas are resonant devices[5]. It will operate in a narrow frequency band. This passive antenna will not be connected with any electrical source. It will get the energy from the receiving electromagnetic waves. Yagi - Uda antenna is the best example for the passive antenna.

## Antenna placements in car

In general, an antenna shall be as high over ground on the vehicle as possible. The higher the antenna is placed over ground, the better is can receive. Then the antenna must be integrated into the car easily. The distance to the receiver shall be not too far so that received signals are not extra attenuated before they are used. The surrounding of the antenna may influence the antenna performance severely. The engine generates spurious noise which can disturb reception, therefore the antenna shall be placed as far away from the engine as possible, but taking all other requirements mentioned before into account[4]. So in total there will be a trade-off between height over ground, Omni directional reception and reducing spurious emissions influences. Requirements for ideal antenna placements are a) Antennas must be high above ground and receive from all azimuth directions b) Antennas must be unobstructed c) Minimum coupling with other metallic structures or antennas d) Distance to receiver (cable-length) short and e) Distance to spurious emissions as large as possible.

Some antenna types require large ground plane, either galvanic connected or coupled. The antenna can be placed in Roof, Screens & Windows, Spoiler, Fender, Trunk and Bumper. At some frequencies a given antenna will not be matched to the transmission line, and will not accept or radiate power, while at those frequencies where the antenna is designed to operate, the impedance of the antenna will allow the electromagnetic energy to pass into the structure and radiate into the surrounding space.

## Proposed system

In the proposed system, we are analyzing the active and passive antenna with the car antenna audio head unit. There are two boards in the receiver kit named as, Main board and Front board. The main board consists of the general power supply, Function Interface, Eternal Connectors, ASP unit, Audio Amplifier and Tuner circuit. The main board will process these operations and send those information to the microcontroller[10]. In this we are using the μPD78F048x microcontroller with 80 pin configuration. This microcontroller will be operated in the range of 1.8 to 5.5v with the maximum frequency of 10 MHz.

In general, the typical problems in the design of modern car radio antennas are matching the antenna to the frequency range of 148 KHz to 1606.5 KHz (LW, MW) and the 49m – band (SW) for AM, TV for wide-frequency bands covering both VHF and UHF bands. Reduction of multipath fading in FM and TV broadcast reception. To avoid the reception of noise generated by the engine and electronic circuits installed in the car. In the AM frequency bands, exact impedance matching is impossible, since the antennas commonly used are electrically very small and thus have extremely small radiation resistance and very large reactance. This problem has been solved by placing an amplifier with low gain (about 2dB) close to the antenna terminals. By introducing this amplifier will help for impedance matching.

FM radio spectrum will be in the range of 870 MHz to 108 Mhz. Each channel will carry ± 100 kHz. The frequency deviation of ± 75 kHz, with the sample rate of $fs > 2f$. There are signals from many radio transmitters in this band inducing signal voltages in the aerial. The RF amplifier selects and amplifies the desired station from the many. It is adjustable so that the selection frequency can be altered. This is called tuning. The tuning is fixed and the tuning filter is wide enough to pass all signals in the FM band. The selected frequency is applied to the mixer. The output of an oscillator is also applied to the mixer. The mixer and oscillator will form a Frequency Changer circuit. This makes the design and operation of the amplifier much simpler. The amplified IF signal is fed to the demodulator.

The noise behavior of this system can be expressed by its system noise temperature TS, which is approximately given by –

$$Ts = TAnt + T R/\mathrm{GN}.$$

Where *TAnt.* is the antenna temperature of external noise, *TR* the noise-temperature of the receiver and *GN* is the available gain of the matching network *N1* and the line. As particularly at microwave frequencies *GN* is generally much smaller than one, the additional noise temperature.

$$TS - T\,Ant = TR/GN$$

This is much higher than the additional noise temperature *TR*, as specified for the receiver alone. If the available gain of the transistor is sufficiently high, the influence of receiver noise on overall system noise-temperature may be omitted and we get:

$$TS = TAnt + TT/GN1$$

TT is the additional noise-temperature of the transistor and GN1 the available gain of the matching network N1.

It should be noted that TT depends on the internal impedance ZA that appears at the input terminals of the transistor. There is an optimum impedance Zopt for which TT becomes minimum TTmin.

As Zopt does not coincide with the optimum impedance Z*A (complex conjugate of ZA) for power match, common pre-amplifiers do not give minimum system noise temperature. The absolute possible minimum of TS with a given transistor is achieved by avoiding all additional matching networks and inserting the transistor at a gap in the antenna where the internal impedance is equal to Zopt. By this way, we can get a noise match (GN1 = 1). The system noise temperature of this active antenna becomes:

$$TS = TAnt + TTmin$$

If the antenna two-port includes active elements, it is an active two-port and an active antenna respectively[4]. This definition will help in simulating the antenna when it is incorporated with an amplifier circuit using any simulation software, whereas the antenna can be represented by its two-port S-parameters matrix.

The Audio head Unit will consist of the main board part and the front board. The main board is consists of power supply circuit and the point which is used to connect the antenna. This AHU will be connected with the car through the Harness.

The front/rear speakers (left & right) shall be connected in parallel at PWB. Thus the two channels shall support 4 way speakers. Internal antenna that can be mounted over the rear view mirror as in present day applications will be used. 4” normal magnet speakers

(10 W) will be used for the two front speakers and 5½” normal magnet speakers (10 W) will be used for the two rear speakers.

## CONCLUSION

In the existing system, there are the separate AHU available for the type of antenna. Depending upon it the power supply circuit has been configured. In this method we can easily handle this two type of antennas with the single kit. The modeled prototype has been done using the MATLAB with Antenna Tool Box.

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