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AM RECEIVER USING SUPERHETERODYNE PRINCIPLE

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Abstract: Our aim is to study and implement an AM RECEIVER based on Super heterodyne principle virtually used in all modern radio and television receivers.This mainly involves the use ofheterodyning. The signal from the antenna is filtered sufficiently at least to reject the image frequency and possibly amplified. The two stages of RF amplifier are used to get desired frequency and 20-23dB gain. A local oscillator and mixer in the receiver produces a sine wave which mixes with that signal shifting it to a very specific intermediate frequency , usually a lower frequency. The IF signals is filtered and amplified and possibly processed in additional ways. The demodulator uses the IF signals instead of the original radio frequency to recreate a copy of the original modulation.

Keywords: Superheterodyne, Sensitivity, Selectivity

I. Introduction

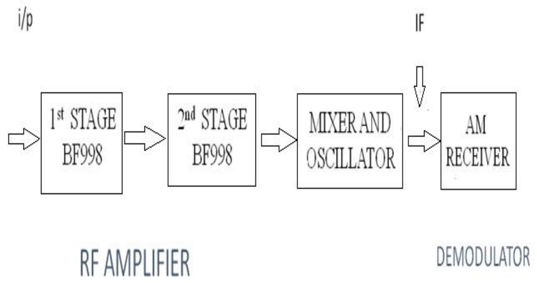
Traditionally, a radio has been considered to be the device that connects to antenna and its purpose is to down convert and filter the desired signal and then digitized the information. Digital receiver can receive any type of modulation either analog or digital modulation standard. The functions of a radio receiver are to select the wanted signal from all those signals had picked up by the aerial to extract the information which has to modulated on to the desired signal and then to amplify the signal to the level necessary to operate the loudspeaker or other receiving devices. The radio receiver can cause interference to the nearby radio because the receiver only receives signals and does not transmit signals. The source of this interference is the local oscillator used in the receiver. The local oscillator usually creates an intermediate frequency at 10.7MHZ for the FM receiver. It implies that the local oscillator is tuned such that IF is always maintained. The most common receiver is super heterodyne receiver and its architecture is chosen for this project. In communication, a super-heterodyne receiver uses the frequency mixing to convert a received signal to a fixed intermediate frequency (IF), which can be more conveniently processed than the original radio carrier frequency. Increase in the number of the FM as well as AM stations has led to high rate of interference between stations.

A superheterodyne receiver is a type of radio receiver that uses frequency mixing to convert a received signal to a fixed intermediate frequency which can be conveniently processed than the original carrier frequency.

Superheterodyne reciever is one of the most popular forms of reciever in use today in a variety of applications from broadcast reciever to two way radio communications links also many mobile radio communications systems.

In this, we will discuss the reasons for the use of superheterodyne and the various topics which concern its design such as use of intermediate frequency, the use of its RF stage, oscillator tracking, bandspread tuning and frequency synthesis.

II. Description



BLOCK DIAGRAM

III. BF998

It is silicon N-channel dual gate MOSFET.

FEATURES

- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier upto 1 GHz

APPLICATIONS

- Used in VHF and UHF applications with 12V supply voltage such as television tuners and the professional communications equipments.

IV. Universal software Defined Radio (USRP)

NI USRP-2920

20 MHz Bandwidth, 50 MHz to 2.2 GHz, Software Defined Radio Device—

The USRP-2920 is a tunable RF transceiver with a high-speed analog-to-digital converter and digital-to-analog converter for streaming baseband I as well as Q signals to a host PC over 1/10 Gigabit Ethernet. You can also use the USRP-2920 for the following applications: white space; broadcast FM; public safety, land-mobile, and low-power unlicensed devices on industrial, scientific, and medical (ISM) bands; sensor networks; cell phone; amateur radio; or GPS

V. Working

The input frequency of 250.65 MHz is given to two stage RF amplifier. This RF amplifier is made using BF998 chip, resistors , inductors,capacitors and variable capacitors. RF amplifier will amplify this incoming signal to a desired level and also gives significant gain. The output of RF amplifier is given to USRP which is software defined radio acts as a mixer and local oscillator that generate an intermediate frequency (IF). The intermediate frequency comes out to be 455 KHz as we are making AM receiver. This single frequency is then demodulated using special kind of function generator which acts as a demodulator. This function generator is having two signals set in it one is carrier signal which is nothing but input frequency coming from source and another one is modulating signal. The modulating signal is modulated in the atmosphere automatically when carrier signal is coming from geostationary satellite. The modulation will be in the form of absorption in different layes of the atmosphere and changed conditions of different layers that are statospere, troposphere, mesosphere, thermosphere and exosphere. By varying the modulating signal significant change in carrier signal will be there. The change will be in the form of compression and expansion. At last by demodulatingthis signal we will get the original incoming signal coming from source.

VI. Advantages

- The low-frequency receiver could be adjusted once, and thereafter all tuning could be done by varying the heterodyne oscillator.
- Amplification could be provided primarily at a lower frequency where high gains were easy to achieve. Amplification was divide between two frequencies, so that the risk of unwanted regenerative feedback could be reduced.
- Narrow, high-order filtering was easily achieved in the low frequency receiver than at the actual incoming RF frequency being received.
- No variation in bandwidth. It remains constant over the entire frequency range.

- High selectivity and sensitivity.
- High adjacent channel rejection.

VII. APPLICATIONS

- Designing and building wireless communications or broadcast equipments particularly radio recievers.
- In electronic warfare.
- In microwave recievers.
- AM recievers designed for medium wave(AM booadcast) the IF is commonly 455 KHz.
- Most superheterodynerecievers designed for boradcastFM(88-108)MHz use an IF of 10.7 MHz.
- TV recievers often uses IF of about 40 MHz.
- Weather sensing.

VIII. Conclusion

After so much work out on this project, we finally got our devices work in the way that we specified. The input frequency to this superheterodyne receiver is 250.65MHz which is free band and very rare. comercially this frequency band is not used because there are no such receivers are available in market to receive this huge frequency. The superheterodynereceiver which we are making is able to receive this frequency which is continuously transmitting from geostationary satellite. When this frequency willtrasmit through different layers of atmosphere there will be some changes in the conditions of these layes. By using this receiver we can observe that changes and can amplitude modulate that frequencies from earth. In this way AM receiver using superheterodyne principle will give the desired frequency and will be useful in various applications.

IX. Future Scope

- To overcome obstacles such as image response, in some cases multiple stages with two or more IFs of different values can be used.
- With a 455 KHz IF it is easy to get adequate front end selectivity with broadcast band (under 1600 KHz) signals.
- Microprocessor technology allows replacing the super-heterodyne receiver design by a software degined radio architecture, where the IF processing after the initial IF filter is implemented in software.
- Radio transmitters may also use a mixer stage to produce an output frequency, working more or less as the reverse of a superheterodyne receiver.

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