

MP3 FM MODULATOR

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DEDICATION

I would like to take this opportunity to thank my supervisor, Mr. Fauzi Bin Abdul Wahab who gave me a guide and teaching in the project. I also want to thank my beloved parents, family members and friends for their encouragement, moral support and valuable opinion.

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ABSTRACT

This project is about constructing an MP3 FM modulator with additional of FM microphone in hardware. MP3 FM modulator is a device that will enable audio sources from computer, Discman, MP3 player, TV audio and others to be played through MP3 FM Modulator, and also for the FM microphone that will enable the system generates and conditions to voice signals. FM transmission and the resultant signal is frequency modulated. The intended receiver for the transmitted signal is a conventional FM radio. The carrier will exist in the FM broadcast band that ranges from 88MHz to 108MHz. MP3 FM modulator enable people who are in same building but want to listen the same MP3 through their radios by just tuning to the frequency of FM modulator. For the FM Microphone enable communication between multiple cars on a road trip by tuning user's cars radio to the transmitting frequency. The main objectives project is to design and construct MP3 FM modulator by adding FM microphone in hardware and to investigate MP3 output signal. The final result is users will be able listen to the MP3 music through the radio by using this device instead of using separate audio system or can speak by using microphone on the device through the radio. Therefore it can save the money to buy the more high quality speaker, and able to extend MP3 audio playback capabilities.

ABSTRAK

Projek ini adalah tentang membina sebuah MP3 FM Modulator dengan penambahan FM mikrofon dalam bentuk perkakasan. MP3 FM Modulator merupakan suatu alat yang membolehkan sumber audio seperti komputer, diskman, alat MP3, audio TV dan sebagainya melalui MP3 FM Modulator manakala untuk mikrofon FM pula akan membolehkan sistem menjanakan dan menentukan kepada isyarat bunyi. Siaran FM dan isyarat paduan ialah frekuensi termodulet. Penerima siaran isyarat adalah radio FM biasa. Pembawa isyarat akan wujud dalam siaran FM di antara 88MHz dan 108MHz. MP3 FM modulator membolehkan mereka yang berada dalam bangunan yang sama tetapi mahu mendengar MP3 yang sama melalui radio mereka sendiri dengan menalakan frekuensi yang sesuai pada pemodulat frekuensi. Untuk mikrofon FM pula membolehkan komunikasi antara pelbagai kereta dalam perjalanan dengan menalakan frekuensi radio pengguna. Tujuan utama membuat projek ini ialah membina suatu MP3 FM modulator dengan penambahan mikrofon FM dan juga kaji penyahkod MP3 isyarat. Keputusan akhir ialah pengguna dapat mendengar MP3 di sebaliknya dengan menggunakan sistem audio yang berasingan atau boleh bercakap dengan menggunakan mikrofon pada alat tersebut dan dapat didengar melalui radio. Oleh sebab itu, ia dapat menjimat kos untuk membeli pembesar suara yang berkualiti dan dapat mempelbagaikan kegunaan pemain MP3.

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LIST OF ABBREVIATION

FM	-	Frequency Modulation
AM	-	Amplitude Modulation
LF	-	Low Frequency
MF	-	Mid Frequency
VLF	-	Very Low Frequency
MF	-	Medium Frequency
HF	-	High Frequency
VHF	-	Very High Frequency
SHF	-	Super High Frequency
N-FM	-	Narrow FM
W-FM	-	Wideband FM
TV	-	Television
PCM	-	Pulse Coded Modulation
IC	-	Integrated Circuit
L	-	Left
R	-	Right
MP3	-	MPEG-1 Audio Layer 3
Vc	-	variable capacitor
RF	-	Radio frequency
VCO	-	Voltage controlled oscillator
PLL	-	Phase Locked- Loop

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays FM signal transmission has become widely used by radio station as well as Mp3 becoming a part of daily life. But not all radios are equipped with additional input ports or capability of reproducing sounds from MP3 file format. The development of this project is to design MP3 FM modulator and FM wireless microphone system so the radio will be able to play the MP3 sound and voice from microphone by tuning to the modulator frequency. Actually the MP3 FM modulator and FM microphone is a device that will enable MP3 audio sources and voice from microphone transmitted to any FM stereo located within the operating range. The system will be designed so that a traditional AM/FM radio will be able to receive the signal and play the transmitted audio sources.

The motivation for this project is to benefit people who are in car or at home want to listen their favorite MP3 songs through a more quality speaker because some radio are not capable to reproduce sounds from MP3 file format. Then if the radios are equipped with CD player, the data size for the CD is also limited, compared to the MP3 FM modulator, we are able to listen to unlimited songs from the audio source through wireless. Besides that, the device is equipped with FM wireless microphone enable users to speak through the radio. So a normal radio can be

utilised as a PA system. Others advantages, it is low cost, versatile, easy to use and no programming needed.

The important of this project is constructing the MP3 FM modulator/FM wireless microphone. For the hardware construction, transmitter will be constructed based on the simulation design and aim to achieve good sound quality and maximise signal transmission.

Below is the function of process when transmitting MP3 to radio.

- i) Input signal conditioning: This includes receiving and preparing the two audio signals to be sent to the next stage of the system. Audio is from the pre-emphasised circuit.
- ii) Stereo Multiplexing: This section includes taking the two input audio signals and stereo modulating them to form one signal that can then be sent to the final stage of this system.
- iii.) Frequency Modulation: This last subproject involves frequency modulating the stereo signal with a carrier in the FM broadcast band so that it can be transmitted and received with a conventional FM radio.

1.2 Problem Statement

MP3 FM modulator is a wireless device which can transmit MP3 songs file format through the radio so benefit to people who are in same building but want to listen the same MP3 through their radios by just tuning to the frequency of FM modulator. Besides that, the microphone at the device can work as a PA system. Therefore, it reduces many wiring cost.

Normally, the CD space is limited when play at CD player of radio. By using the MP3 FM modulator we can listen unlimited MP3 song from audio source like computer through the radio with high quality speakers and able to extend MP3 audio playback capabilities.

Besides that, by addition of FM Wireless microphone has advantages for freedom of movement for the users or speaker. For FM Microphone enable communication between multiple cars on a road trip by tuning user's cars radio to the transmitting frequency in a limited distance. The MP3 FM modulator takes advantages because of adding this type of function.

1.3 Objectives

1. To investigate and study about MP3 output signal.
2. To investigate the available FM channel in Malacca.
3. To design and simulate a suitable FM transmitter
4. To construct the MP3 FM modulator with additional microphone circuit.
5. To fine tuning the MP3 FM modulator and FM wireless microphone to a suitable frequency.

1.4 Scopes Of Work

- MPEG-1 Layer 3 (MP3) with bit rates 32-320kbit/s and the available sampling frequencies is 32, 44.1 and 48KHz can used as an input audio source.
- The maximum of audio input is 5.66Vpp (2.0Vrms).
- MP3 FM modulator that will broadcast the stereo signal only in the 88-108MHz FM band.
- Find the accurate frequency when transmit the MP3 songs or speak at microphone to radio by tuning to frequency different from radio station FM. For example can use 100MHz and 95 MHz at Malacca FM.
- The noise occurs predominantly at the highest frequencies within the baseband. This can reduce the high frequency noise by pre-emphasis process. The amount of pre-emphasis is defined by time constant which use 50 μ s time constant.
- The distance of MP3 FM modulator and FM microphone to transmit the signal to the FM radio is in the range of 30-40 meter.

1.5 Thesis Outlines

First, do the research and literature review where it is a process to find out some theory that related to project. The theories that find out are radio broadcast, modulation of radio wave, MP3, what transmitter is, oscillator, multipliers, and modulator. After that, do the review of previous studies that may be related to this project. Then, do the research for designing a circuit. All of this research and literature review will discuss in Chapter II. The designed circuit should be simulating to get the output graphs by using the Multisim software and the results of hardware by using spectrum analyser will discuss in Chapter IV. After that, the research methodology of this project will discuss in Chapter III. Finally, do the conclusion in Chapter V.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, literature means the works you consulted in order to understand and investigate your research problem. A literature review discusses published information in a particular subject area. The literature review is done by interviewing the users and reviewing sources from books, web pages & e-book, technical reports, journal, anonymous reference, proceeding conferences and publication of international bodies/ agencies.

2.2 Radio Broadcasting

Sound broadcasting for entertainment and educational purpose constitutes the biggest network of radio communication for circuit all over the world. Amplitude Modulation (AM) Broadcast transmitters will continue to provide the basic service for national as well as international large area coverage of broadcasting by the use of high power long wave, Medium wave and short wave transmitter. The new generation of AM transmitter, either fully transistorised for Medium Power Low Frequency (LF) or Mid Frequency (MF) service; or single output tube type for short wave and high power MF and LF broadcasting, based on low level digital processing and control, will prove much reliable and economical service both from the

consumption and operational points of view. Use of frequency Modulation (FM) services for internal broadcast has added another dimension to the information and broadcast service. In this project, it is possible to transmit FM stereo in available VHF FM broadcast. Below is the classification of Radio waves and their propagation characteristic: [2]

Table 2.1: Radio waves and their propagation characteristic

Class	Frequency range	Propagation characteristic and typical uses
Very low frequency (VLF)	10 to 30kHz	- Low attenuation - Used for long distance communication.
Low frequency(LF)	30 to 300 kHz	-Used for marine communication and navigational aid.
Medium frequency(MF)	300 to 3000kHz	- High attenuation during day. - Less attenuation at night. - Suitable for broadcasting and marine communication.
High frequency (HF)	3 to 30 MHz	-Propagation characteristic vary with time of day. - Frequency used for long distance communication.
Very high frequency (VHF)	30 to 300 MHz	-Line of sight propagation - Not affected by ionosphere -Used for television, FM Transmission and radar.
Ultra high frequency (UHF)	300 to 3000 MHz	- Line of sight propagation - Used for television and short distance communication
Super high frequency (SHF)	3000 to 30000 MHz	