

# **Circuit Description**

**BST-1 SHORTWAVE RADIO**

**FCC ID 2AF6LBST1**

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## **INTRODUCTION**

The BST-1 is a shortwave receiver intended for vehicular use. It operates from a standard 11-14 VDC automotive electrical system. It has a 2-25 MHz AM shortwave receiver that tunes in 5 KHz channels and a built-in FCC Part 15 compliant FM transmitter. The FM transmitter allows the shortwave audio to be received by the vehicle's FM radio and audio system. The tuned shortwave frequency and signal level will also be displayed on vehicle FM radios that have RDS capability. The BST-1 is tuned by wireless remote control using a FCC Part 15 compliant 433 MHz key fob (not part of this certification) that communicates with a 433 MHz data receiver in the BST-1.

The circuitry is contained on one main printed circuit board with one sub-board that contains the 433 MHz data receiver. The main PWB may be constructed with either wire leaded or surface mounted devices (SMD). An extruded aluminum case houses the circuit board. The external connections are one RCA type jack for the shortwave receiver input and a 2.1 mm DC power plug for external DC power input. A permanently attached antenna is used for the FM transmitter and the 433 MHz data receiver.

## **THEORY OF OPERATION OF FM TRANSMITTER**

Referring to the schematic of the BST-1, IC3 provides the complete FM transmitter function. The frequency of operation is restricted to 88.3, 88.5, 88.7 or 88.9 MHz as determined by a serial data command from IC2, the microprocessor. Y2, C36 and C15 form a 32.768 KHz crystal controlled oscillator which determines the FM transmitter frequency with an accuracy of 200 PPM. L6, L8 and C13 filter the output of the FM transmitter. Audio from the internal shortwave receiver is coupled in to the FM transmitter via C36 and C36. Morse code audio to aid in tuning is coupled into the FM transmitter by C6. FM transmitter deviation and transmitter power is set by internal software within the microprocessor and IC3 and can't be modified by the user.

## **433 MHz DATA RECEIVER**

The data receiver receives data transmitted by an external 433 MHz key fob transmitter. Any FCC Part 15 certified key fob with suitable data format may be

used. One such item is manufactured by Linx with FCC ID OJMOTX400HHKF.

T2 and associated components provide the RF amplifier function at 433.92 MHz to set overall receiver sensitivity. T1 and associated components are a superregenerative receiver to provide the demodulation of incoming 433.92 MHz data signals. IC4 amplifies the low level demodulated data signal and increases the level to 5V logic for use by the microprocessor.

Because the 433 MHz receiver is part of a transceiver is it subject only to FCC Part 15 verification.

## **SHORTWAVE RECEIVER**

The shortwave receiver is not subject to any separate FCC Part 15 requirements since all internal frequencies and the operating range are below 30 MHz.

For reference, the circuit is described. IC1 provides a complete 2-25 MHz receiver using Y1, C25, and C9 for frequency control with a 32.768 KHz oscillator. Shortwave signals are amplified and filtered by Q1 and Q2 and the RF filter located between these two stages. The receiver is tuned by the microprocessor and demodulated audio applied to the FM transmitter, IC3. The receiver normally operates with a 20" external whip type antenna.

## **MICROPROCESSOR**

IC2 is a self contained type 8051 microprocessor with an internal 12 MHz clock. It controls the entire operation of the BST-1. It has 16K of memory and is programmed during production test by a serial programming connection. No user modification of the program is possible and the software code is locked to prohibit viewing or modification.

## **POWER SUPPLY**

11-14 VDC from vehicle power is applied through CR1 to prevent damage from reverse polarity. L3, C38 and C34 provide filtering from any external interference. The vehicle power is regulated to +5 V by T5, CR2, CR5, R31, R32, and R19. D5 and LED provides indication when external power is applied.