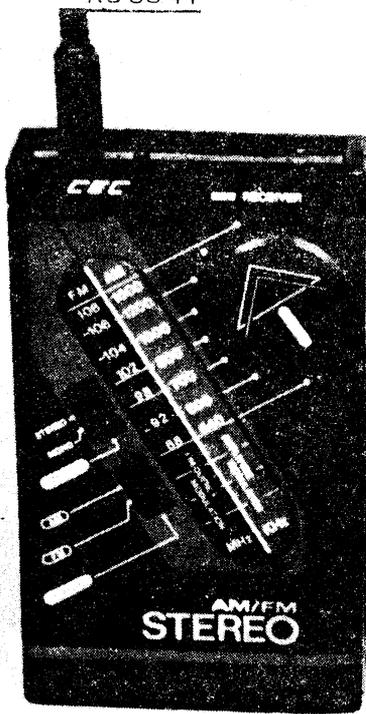


FM STEREO TRANSMITTER



The Mini-mitter is a miniature stereo FM transmitter using just one integrated circuit and powered by one 1.5V penlite cell. You can connect your CD player to the Mini-mitter and then listen to your favourite CDs anywhere in the house, via your Walkman personal portable.

By JOHN CLARKE & LEO SIMPSON

How would you like to listen to your favourite CDs and records via headphones without being tethered to your stereo system? Maybe you want to wash the car, mow the lawn or vacuum your house while you listen to your favourite music. Clearly, a Walkman-style cassette player will let you listen via headphones while you work but who wants to go to the trouble of dubbing a record to tape every time the mood hits you.

Or maybe you have a portable CD player and you'd like to listen to CDs via your car radio. Most car radios do not have connections for an external program source so that

can be a real problem.

If you have these problems, the Mini-mitter is the answer. You can connect it up to your stereo system and broadcast your own stereo music program on the FM band; ie, 88-108MHz. The Mini-mitter puts out a flea-power signal (around 200 microwatts or so) but that is enough to give clean stereo sound over the average portable FM radio within a range of 20 metres or so.

You can use it in your car with a portable CD player, to avoid making any connections to your car radio. Just connect the CD player up to the Mini-mitter and tune in your car radio to the correct frequency to

hear the program of your choice.

The Mini-mitter is built into a small case and powered from just a single 1.5V AA size cell. Two RCA sockets are provided at one end of the case for the left and right audio channels. At the other end, there is a length of wire which is the transmitting antenna and there is a slide switch to turn the Mini-mitter on or off.

Inside the case, there are a couple of trimpots to adjust the level of the left and right channel audio signals. These are important to obtain minimum audio distortion, especially when listening to compact discs.

There are also internal adjustments to vary the transmitter frequency anywhere within the 88 to 108MHz FM band. We'll talk about these later.

As you can see from the specs, battery cost will not be a problem. A normal penlite cell should last for many months even if you use it for several hours every day.

A single IC provides all the

Constructor Please Note

The 1.5V AA Battery shown in the parts list, is not supplied in the kit.

The two formers for L1 & L2 are supplied with pins in the base, to mount the formers first remove the pins and insert into the board from the underside as mentioned in the article.

How an FM Stereo Transmitter Works

Fig.3 shows the block diagram of a stereo transmitter as typified by the Mini-mitter. The left and right channel inputs are applied to trimpots and then to 50 μ s pre-emphasis circuits (to provide treble boost above 3kHz, to the Australian FM standard).

After pre-emphasis, the left and right signals are fed to buffer amplifiers and then to the multiplexer which is driven at 38kHz. This produces a sum (L + R) signal and a difference (L - R) signal which is amplitude modulated on a 38kHz carrier. The carrier is suppressed to provide a double sideband suppressed carrier signal.

The (L + R) and (L - R) signals are mixed with the 19kHz pilot signal which is derived by dividing down the 38kHz oscillator signal by two. The resulting composite signal is then frequency modulated onto a carrier frequency in the FM band. Once filtered and amplified in the RF amplifier, the signal is transmitted via the antenna.

Fig.4 shows the spectrum of the composite stereo signal. The L + R signal occupies the frequency range between 0 and 15kHz. The double sideband suppressed car-

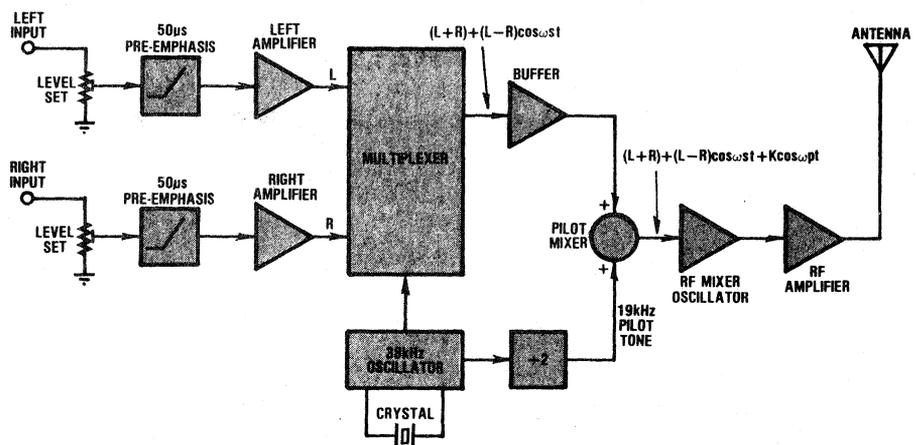


Fig.3: block diagram of an FM stereo transmitter, as used in this project. The accompanying text explains how it all works.

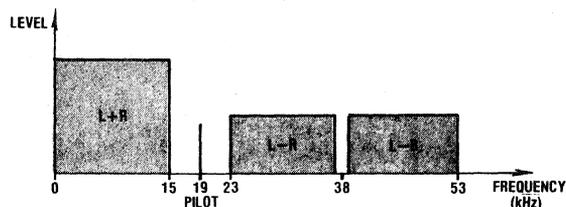


Fig.4: frequency spectrum of the composite transmitted stereo signal. Note the pilot tone at 19kHz.

rier signal (L - R) has a lower sideband which extends from 23-38kHz and an upper sideband from 38-53kHz. There is no sub-carrier at 38kHz.

The pilot carrier at 19kHz is also shown. The pilot tone is used by the receiver to reconstitute the 38kHz subcarrier so that the stereo signal can be decoded.

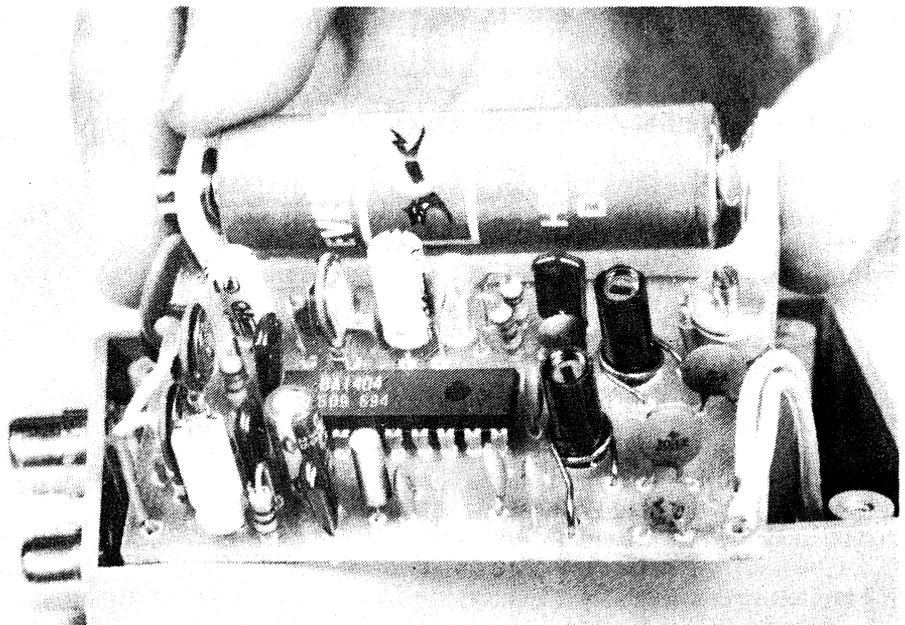
connection goes to the earth track adjacent to this antenna terminal and is soldered to the underside of the PCB.

You can buy a ready made dipole antenna from Jaycar (Cat. LT-3002) or Arista outlets (Cat. FMA1).

VR3 should initially be set to the centre position. Now insert a 1.5V AA cell into the battery holder and check that there is 1.5V across pins 3 and 15 with a multimeter.

Initial checks

Operation can initially be checked with an FM tuner set to an unused frequency near the centre of the band. Insert slugs into L1 and L2 and adjust both so that each slug is about 2mm below the top of the former. Now adjust the L1 slug until the tuner receives the signal. This can be detected by the level and/or



This close-up view clearly shows the winding details for L1 and L2. The PCB clips into guides running down each side of the plastic case (see text).

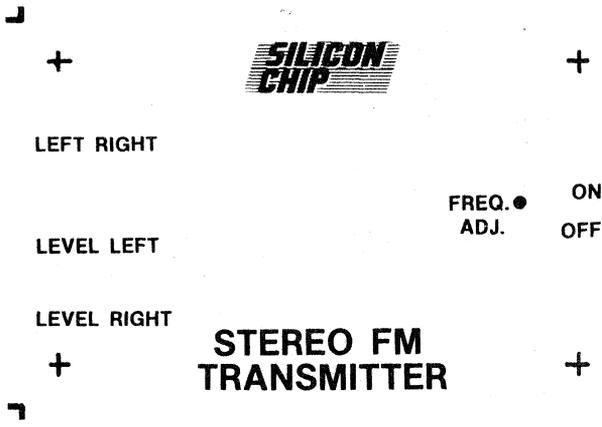


Fig.5: actual-size artwork for the front panel.

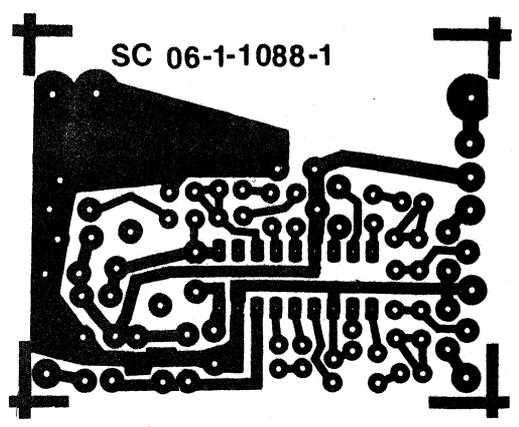
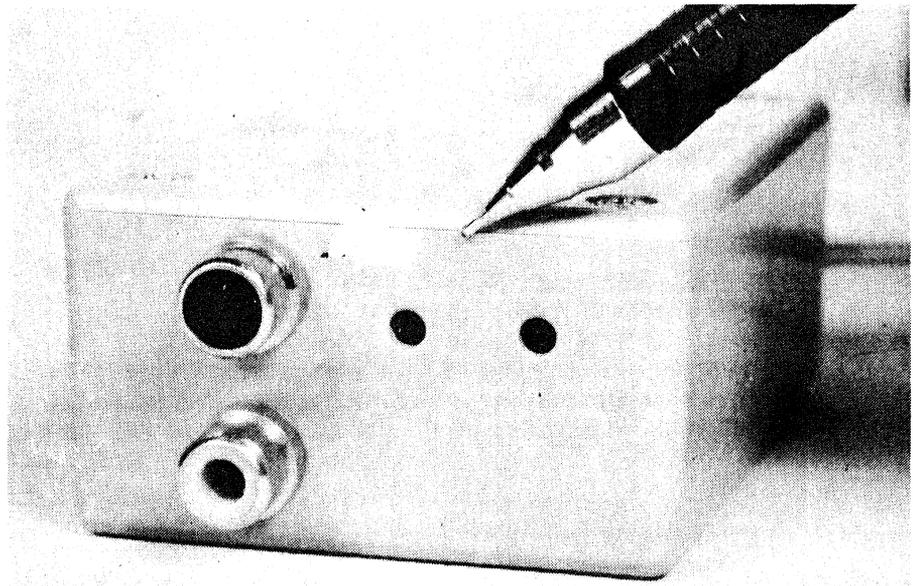


Fig.6: actual size PCB artwork.



The two small holes in the end of the case allow screwdriver access to the level adjustment trimpots, VR1 and VR2. A third hole in the lid of the case provides access to trimmer capacitor C1 for frequency adjustments.

tuning meter on the FM tuner and/or by a stereo light indication. The L2 slug is then adjusted for maximum signal.

To set the transmitter on other parts of the band, the slugs must be low down into the coils for the low frequency end of the band and conversely, higher for the high end of the band. Note that both slugs should be set in similar positions in the former for best results. The coils are slightly interactive so that adjusting one will affect the other.

For fine tuning, use the trimmer C1. The slugs can be secured in position using a very small amount of candle wax. Alternatively, some

dental floss inserted into the former before the slug will help stop movement.

To adjust the input level trimpots, connect a program signal to the RCA sockets and listen to the output from the tuner, preferably via headphones. Adjust the trimpots so that distortion is not present on loud signals. This is easy to do because when the distortion is present it sounds awful.

If you have an AC millivoltmeter and sine wave oscillator you can also set trimpot VR3 for maximum separation between channels. If not, just leave VR3 centred as this will be close to the optimum setting.

PARTS LIST

- 1 PCB, code SC06-1-1088-1, 47 x 60mm
- 1 plastic case with plastic lid, 83 x 54 x 28mm
- 2 RCA chassis mounting sockets
- 1 AA cell holder
- 1 1.5V AA battery
- 1 sub-miniature slider switch
- 2 Neosid 722/1 5mm coil formers
- 2 Neosid F16 4mm ferrite cores to suit formers
- 1 38kHz miniature crystal
- 1 BA1404 Rohm FM stereo transmitter IC
- 1 100mm-length of 0.63mm enamelled copper wire

Capacitors

- 2 10µF 16VW PC electrolytic
- 2 4.7µF 16VW PC electrolytic
- 3 .01µF miniature ceramic
- 4 .001µF metallised polyester
- 1 330pF polystyrene
- 2 47pF miniature ceramic
- 2 15pF miniature ceramic
- 1 10pF miniature ceramic
- 2 4.7pF miniature ceramic
- 1 2-10pF trimmer capacitor (Philips 2222 808 11109)

Resistors (0.25W, 5%)

- 1 x 100kΩ, 2 x 47kΩ, 1 x 2.7kΩ, 2 x 10Ω, 1 x 50kΩ miniature vertical trimpot, 2 x 10kΩ miniature vertical trimpots

Miscellaneous

Small self-tapping screws, hookup wire, tinned copper wire.