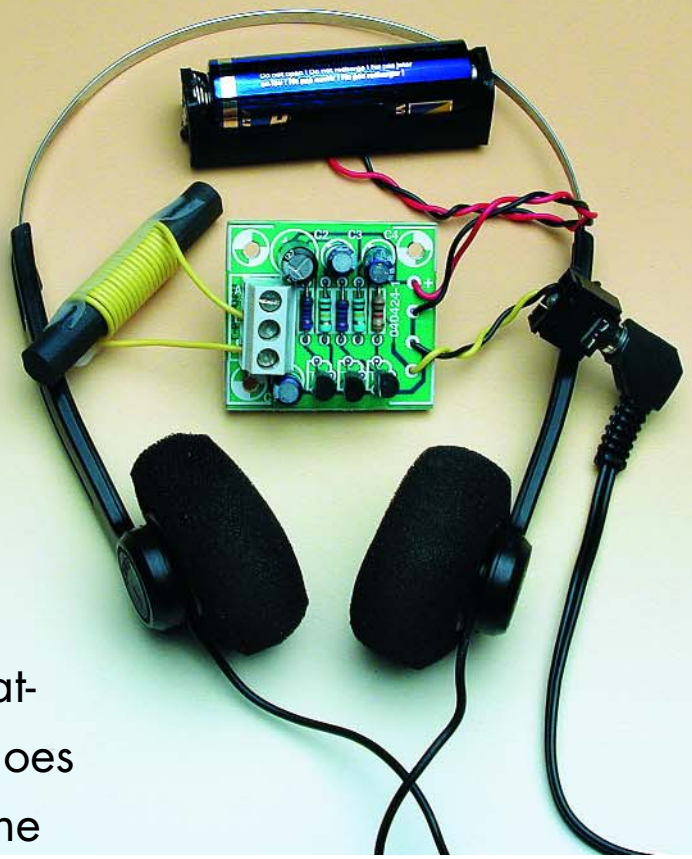
Tune in to Elektrosmog

Listen to EMF soundscapes



Burkhard Kainka

The debate concerning the possible harmful effects of electrical and magnetic alternating fields in our environment goes on. The only thing that everyone seems to agree on is that you cannot see or smell these fields. No longer true! Build this simple electrosmog detector and add two extra senses to the five that you already have.

Electrosmog is a relatively new term referring to the electrical and magnetic fields (EMF) emitted by almost all the electrical equipment that we fill our environment with. Papers on the subject indicate that we cannot hear or see these fields but their effects on our body may prove to be harmful in the long term. The electrosmog detector is a very simple portable design that allows you to listen in to both magnetic and electric field activity. Take the detector on a tour around your house or even around town, you will be surprised at just how noisy the invisible worlds of magnetic and electric fields can be.

The detector circuit

The circuit diagram shown in **Figure 1** consists of a sensitive LF (low frequency) amplifier with a headphone output socket. The three stage direct-coupled amplifier automatically adjusts its bias point via a DC feedback path from the output through R4 and R2; any AC signal components are shunted to earth via capacitor C3. The output voltage level will be at 0.7 V with no input signal. The whole circuit runs from a supply voltage in the range of 1.2 to 1.5 V provided by a single battery. The amplification factor achieved by this configuration is so high that you can clearly hear the noise signal

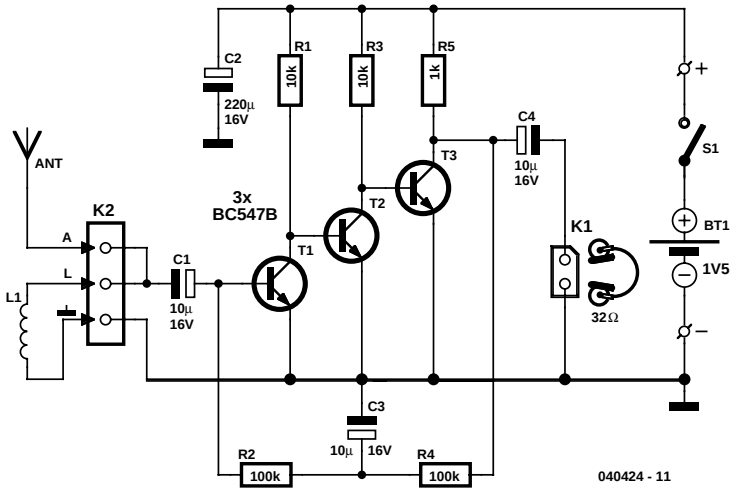


Figure 1. The circuit consists of a sensitive LF amplifier with an earphone output socket.

produced by T1 in the headphones. For this reason it is a good idea to use a low noise transistor like the BC549C for the first stage of the amplifier. Input signals at the microvolt level are sufficient to produce an output; there is little point in increasing the amplification factor further. The low supply voltage ensures that even if high signal levels drive the amplifier into saturation, the headphone sound intensity will never be excessive.

This circuit could also be used as a sensitive microphone amplifier but for this application it would be necessary to decrease the amplifier bandwidth so that unwanted HF signals will not be amplified. The detector circuit does not contain any low pass filters so it is sensitive to HF signals also. Non-linear transistor characteristics have the effect of demodulating these high frequency signals so that they also can be heard.

The circuit PCB shown in **Figure 2** greatly simplifies the job of construction. A three-way terminal block is used to connect the pick-up coil and aerial wires to the PCB while solder pins provide connections for the headphone socket and battery leads. A 3.5 mm jack socket (K1) allows normal Walkman type stereo earphones to be used. The output signal is mono so socket connections to the left and right earpieces can be wired either in parallel or series; try both connections to see which one sounds best. It is also possible to use just a single earpiece providing it has an impedance greater than 32 Ω.

The EMF aerial

A pick-up coil or antenna can be connected to the input of the circuit to allow it to detect magnetic or electric fields respectively. The pick-up coil specification isn't critical, a flat coil from a broken floppy disk drive mechanism was used in the prototype but you can experiment with whatever you have to hand, in this case a screwdriver is far more useful than a calculator. A coil consisting of around 200 turns on a 20 mm diameter former can be wound up if you cannot find an alternative. The wire gauge is not critical. A ferrite rod or an open transformer core can also be used. The primary (230 V) winding of a small discarded mains transformer will also make an effective pick up coil because not all the magnetic field in a normal transformer is constrained to the core. It is these stray fields leaking from any transformer in operation that are picked up by the detector.

Magnetic-field noise sources

Using an air-spaced 200-turn coil it is possible to hear magnetic field activity generated by:

– Electrical appliances using mains transformers. These emit magnetic fields that can be detected up to 20 cm away.
– A power cord or mains wiring concealed in a wall will only produce a field when power flows through the wires.
– All types of fluorescent tube lighting produce a buzzing note with overtones. Low-energy lamps have a built-in voltage converter that produces a characteristic whistling.
– An alarm clock with a quartz movement produces a double tick for each step of the second hand.
– Switched-mode mains adapters emit a humming whistling sound.
– Televisions and CRT computer monitors produce different frequency signals in the region around the screen and the power supply.
– Loudspeakers and headphones emit magnetic fields as well as sound pressure waves.
– DECT telephones periodically produce bleeps when the phone is on-hook and send out a whole series of bleeps and twittering when you make a call.
– An oscilloscope produces a detectable magnetic field with a repetition rate equal to its timebase setting (turn up the beam intensity).
– Equipment that is apparently switched off or in standby mode may produce signals; this indicates that the equipment is active and drawing current.

Not so long ago you might have attracted some odd looks if you were to walk through town wearing earphones but now almost every other person you meet is plugged into their own source of personal entertainment so you will not cause too many raised eyebrows by taking the detector out onto the street. It is quite surprising to hear all the EMF activity that you can pick up while walking through town or visiting public buildings. Mains transformers are everywhere and can be recognised by their characteristic mains frequency hum. The High Street and shopping malls also has many examples of switched mode power supplies and each has its own individual spectrum of signals allowing the type of equipment to be identified with practise. Automated ticket dispensers and drinks machines also have their own characteristic sounds. Most museums and public places are now

COMPONENTS LIST

Resistors:
R1,R3 = 10kΩ
R2,R4 = 100kΩ
R5 = 1kΩ

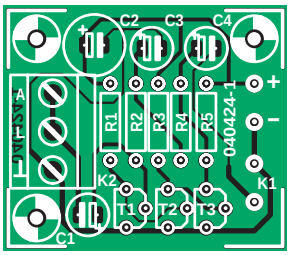
Capacitors:
C1,C3,C4 = 10µF 16V radial
C2 = 220µF 16V radial

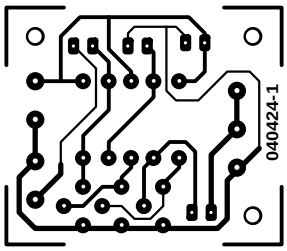
Semiconductors:
T1,T2,T3 = BC547B (for T1 also BC549C, see text)

Miscellaneous:
S1 = on/off switch, 1 contact
Bt1 = AA battery (preferably alkali-manganese) with holder
K1 = 3.5-mm jack socket, stereo (see text)
K2 = 3-way PCB terminal block, 5mm lead pitch
PCB, ref. **040424-1** (Elektor Shop)
L1 = pickup coil, if necessary with ferrite core (see text)
ANT = length of wire (see text)

Figure 2. Even though there are only a few components, construction is much easier with a PCB.

Figure 3. The author's original pick-up coil.





equipped with an inductive loop voice transmission system throughout the building (look for the blue sign with an ear symbol and the letter 'T'). This system allows the hard of hearing to pick up information on their hearing aid without any of the distracting background noises. The electrosmog detector can also listen in to these signals.

The Electrical world

The detector can also pick up electric field activity. To listen-in replace the pick-up coil with a small stub aerial or short 10 cm length of wire. Place the aerial close to a power cord that is connected to the mains and you will be able to hear the field even though the mains switch on the equipment is off and no current is flowing. It is quite difficult to find any place at all where there are no humming or buzzing noises. Fluorescent tube lighting and low-energy lamps also have a characteristic sound with loud harmonic overtones. Oscilloscopes use a very high voltage to accelerate the electron beam and this produces a higher level of electric field than magnetic. Waving the aerial around electrical equipment always produces surprising results for example the buzzing emitted by a vacuum fluorescent display on the front panel of a stereo amplifier and more reassuring the relatively low level of fields produced by modern low-emission CRT monitors.
It is also possible to make the detector sensitive to both electrical and magnetic fields by fitting both the aerial and the coil at the input. Try experimenting with different lengths of aerial and other coils and don't be surprised if you pick up radio broadcasts, radio transmitters also produce alternating magnetic fields.

Two hundred years ago electrical storms and solar radiation were probably the only source of electric field activity on the planet but nowadays you would be hard pushed to find any corner of the globe that is not continually bathed in electrosmog!

(040424-1)

Electrosmog in your ear

It is not only contemporary musicians and ambient/noise bands like Orbital, Nine Inch Nails and Einstürzende Neubauten who use sound to express themselves artistically. There is also a movement within contemporary art that specialises in locating, recording and manipulating unconventional sounds in the environment to make 'sound sculptures' or 'soundscapes'. For example, there has recently been UK media interest in the work of an artist who attaches sound sensors to railway suspension bridges. The German artist Christina Kubisch is also active in the field of 'sound art' and exhibited in Cologne in 2004 along with seven other artists from seven different countries. Visitors were invited to don a set of special headphones and take a stroll through the city. The headphones enabled them to actually hear magnetic fields in the busy city centre and the environment.

Engineer Manfred Fox developed the special headphones. Their design was based on inductive loop headsets used in museums and art galleries to provide visitor information. The inspiration for the project came when it was noticed that these headsets were also capable of picking up (unwanted) signals from other magnetic field sources in the exhibition area.

The artist's homepage is at: www.christinakubisch.de