

Acoustically Tuned CW Loudspeaker

Here's a natty idea from Richard Q Marris G2BZQ for all you Morse fanatics—an acoustically tuned c.w. filter. This simple low-cost audio device will clean up the Morse from the crudest receiver, it won't make up for the lack of good i.f. filtering, but then few audio filters will. Build it and see what you think.

Manufacturers of communications receivers go to a lot of trouble to produce sets that will recover good quality audio from both s.s.b. and c.w. signals. This normally means including several i.f. filters to give the necessary selectivity for each mode. However, sometimes to keep the price of the receiver within market parameters, corners are cut and it's normally the c.w. mode that suffers. This is where a little outboard audio filtering comes in handy.

To make a c.w. signal audible on an a.m. detector, a b.f.o. is needed. This is set to a slightly different frequency to that of the receiver's i.f. The difference between the i.f. and the b.f.o. frequency, is the note of the recovered audio signal. The difference, on a more complex receiver, is often preset to between 400Hz and 1000Hz. However, a receiver with a tunable b.f.o. allows the listener to select his favourite note, the author's preference is around 850Hz. Unfortunately, what with the overcrowding on the h.f. bands and all the man-made static, the 850Hz c.w. signal isn't all that one hears.

The compromise mentioned earlier regarding the i.f. filter, is also to an extent true of the receiver's audio transducer, loudspeaker or phones. These are often high quality devices capable of reproducing a far too wide a band of audio frequencies. This is where the author started to think about producing a transducer that had tailored response for c.w. signals.

Experiments followed to re-tune the response of a loudspeaker, which by design, already had a limited bandwidth. The loudspeaker used is an 8Ω, 50mm (2in) dia Mylar cone device, which has a 500mW rating and a frequency response of 400Hz–5.5kHz. Hardly hi-fi! Mylar loudspeakers have ferrite magnets and are generally used for sirens and alarms, hence the limited frequency response. This speaker combined with the tubular enclosure shown in Fig. 1 forms the basis of an acoustically tailored c.w. speaker. The enclosure is a 56mm outside dia. tube, 227mm long, the speaker is sealed into one end and the sound exits through a small hole in a cap at the other. The prototype speaker made roughly to the dimensions given, showed a marked peak in its response at 850Hz.

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Construction

The enclosure is made from a 227mm section of cardboard plan tube. These are generally available from most large stationers and come complete with tightly fitting plastics end caps. The tubes are made in a variety of lengths right up to 1m, however, the internal diameter is important and must be just slightly larger than the diameter of the speaker.

Having selected a suitable diameter tube, remove one end-cap and roughen its inner face. Using silicone rubber compound, glue the speaker magnet to the cap. Wait the recommended setting period of the glue, then take the speaker assembly and carefully make a small hole in the cap just behind the speaker terminals. Thread a length of miniature screened cable through the hole and connect it to the loudspeaker. Make the cable entry airtight with a small amount of the silicone compound. Finally, wire a suitable audio jackplug to the speaker lead and fit the cap plus loudspeaker into the tube.

Adjustment

The diameter of the small hole in the other end cap determines the applied top-cut frequency; the smaller the hole, the greater the top-cut. The hole diameter needs to be between 1.5mm and 6mm, beyond this size the background noise rises rapidly. On the prototype the final hole size chosen was 4.5mm diameter. The bass-cut frequency can be adjusted by decreasing or increasing the length of the tube. It should be noted that adjusting either the bass-cut or top-cut will have an interactive effect.

In practice the best method to determine the hole size required, is to drill a

number of different diameter holes into a piece of thin plastics sheet and then hold each one in turn over the mouth of the tube. The resonant frequency of the tube may then be found by sweeping the receiver b.f.o. across a reasonably strong c.w. signal and noting when the desired note is considerably enhanced. The correct hole size can then be made in the centre of plastics end cap. The plastics sheet used for the experiment was cut from the side of a 1.5 litre milk container, as this material is very similar to that of the end cap.

Results

The end result is a low-cost, narrow band c.w. speaker, the construction of which although simple should be done with great care. The resonance of the speaker is quite sharp as when tried on a normal a.m. broadcast signal, all that will be heard is a rather strange "Donald Duck" sound.

During the experiments a formed steel tube was tried which gave a pleasantly crisp, slightly ringing note. Unfortunately a secondary low-level resonance occurred producing a background hissing noise, or sea-shell effect. In this experiment the hissing noise defied all attempts to remove it acoustically without losing the crispness of the c.w. note as well.

The audio from the loudspeaker has a rather unfortunate penetrating effect not appreciated by other householders, particularly during early morning and late evening DX sessions.

This speaker is a low-level device and is somewhat directional. It should be placed as close to the ear as is practical. Finally the speaker could be mounted to a wooden plinth using either large Terry or plastics plumbing clips.

PW

WDM298

