Here's a nifty construction project that will improve the quality of your signal without adding an extra watt.

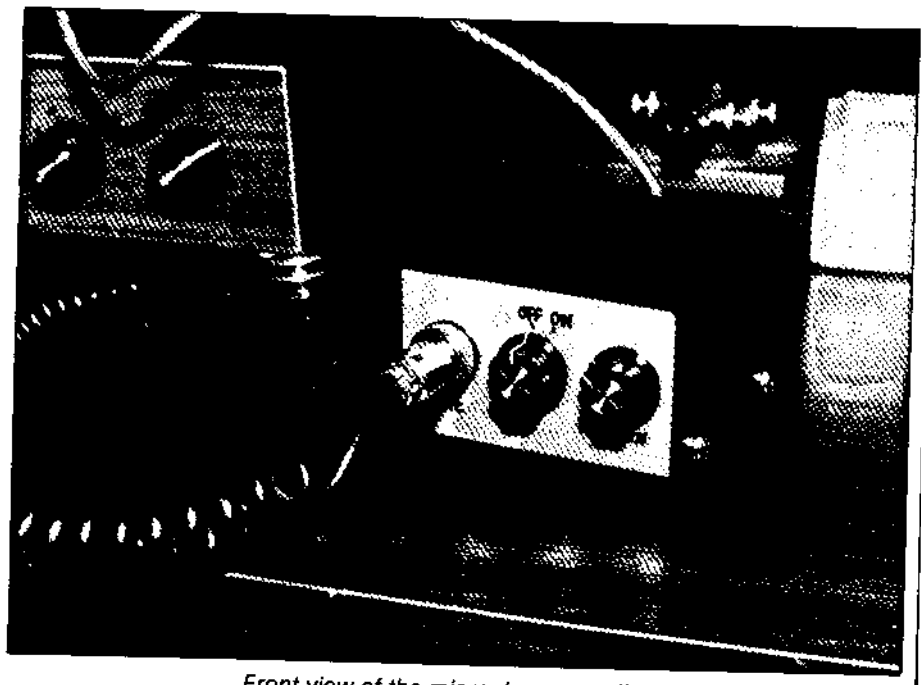
Build Your Own Microphone Equalizer

BY CORNELIO NOUEL*, KG5B

It is a proven fact that speech frequencies between about 200 Hz and 4000 Hz contribute the most to intelligibility. Frequencies above and below these limits serve mainly to give identity or personality to the individual's voice.

In order to save frequency spectrum, present-day communication equipment restricts the bandwidth of the audio channel to those essential frequencies, both on transmit and receive. Under ideal conditions an overall flat frequency response will provide the best results; however, there are times when some intervening factor, such as the operator's voice or the microphone response or room acoustics, may affect the clarity required, especially under noisy conditions.

The unit described here, although not a cure-all, will help to modify the response of the audio to be transmitted within the passband of the equipment.



Front view of the microphone equalizer.

Description

The equalizer is a very simple and inexpensive unit. It can be built in a couple of evenings by practically anyone with a little experience. The circuit consists of a preamplifier, a low-frequency network, and a high-frequency network. These are also call **bass** and **treble** networks.

The amplifier provides about 30 dB gain, while the network losses add up to about 10 dB. Therefore, 20 dB of extra gain is available to compensate for variations in microphone levels.

In the schematic diagram (fig. 1) R5 controls the low frequencies, while R9 controls the high frequencies. The action of each control is quite independent of the other controls. The amount of **boost** or **cut** can be appreciated from the frequency response chart (fig. 4), which is an actual plot of the unit shown in the photograph and the schematic. A 20 dB spread is possible within the normal communications passband. R10 is a 10K ohm audio taper potentiometer which adjusts the output level of the equalizer so that it will not exceed the required amount.

The input signal goes through selector switch S1, a three-pole two-position rotary switch which selects the **In** or **Out** operation. This switch also turns the battery on or off. Battery current drain is only about a half ma at 9 volts. The equalizer will work with microphones with impedances from a few hundred to several thousand ohms.

When the **bass** and **treble** controls are set at their mid-position, the overall response of the unit is virtually flat from 20 Hz to over 20,000 Hz with little distortion.

To prevent r.f. feedback, the input circuit is provided with an LC low-pass filter consisting of a 330 μHy miniature ferrite-core choke and a 270 pF capacitor. No r.f. feedback has been observed while operating on the h.f. bands using a tuned antenna system and 100 watts output.

The 2N3390 transistor shown in the diagram is a high-gain, low-noise, audio-type NPN, but there is no reason why similar transistors cannot be substituted (for example, the RCA SK3245, or equivalent).

Construction

My equalizer was built in a small metal cabinet (Radio Shack Cat. # 270-251) to

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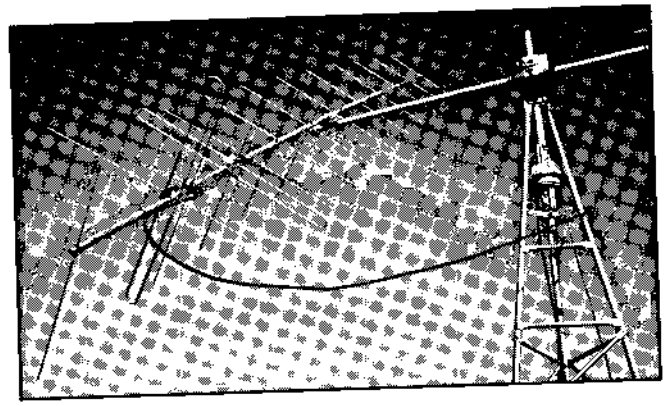
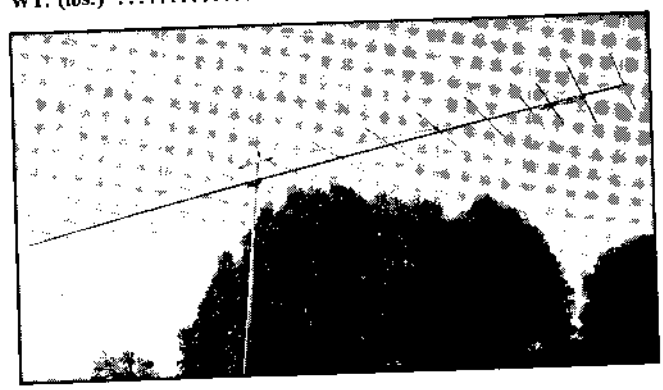


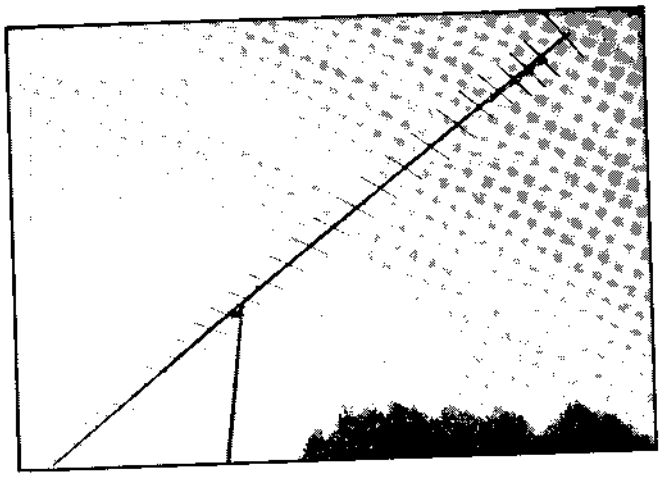
2M-22C

BANDWIDTH	144–148 MHz
*GAIN	13 dBdc
BEAMWIDTH	(E) 32°, (H) 32°
FEED IMP	50 ohms unbal.
BALUN	(2) 4:1 coaxial
BOOM LENGTH	19 ft. 1 in. (tapered)
VSWR	1.5:1
WINDLOAD	1.85 sq. ft. max.
ELLIPTICITY	± 1.5 dB max.
CIRCULARITY SWITCHER	CS-3 included
WT. (lbs.)	11 lbs.



2M-16LBX

BANDWIDTH	144–146 MHz
*GAIN	(144 MHz) 14.5 dBd
BEAMWIDTH	(E) 26°, (H) 29°
FEED IMP	50 ohms unbal.
BALUN	4:1 coaxial, 2 KWPEP
BOOM LENGTH	28 ft. 1 in. (tapered)
VSWR	1.5:1
WINDLOAD	(H) 1.75 sq. ft. (V) 2.44 sq. ft. max.
WT. (lbs.)	10 lbs.
TURNING RADIUS	15 ft. 5 in.



432-30LBX

BANDWIDTH	430–440 MHz
*GAIN	17.3 dBd
BEAMWIDTH	(E) 19°, (H) 20°
FEED IMP	50 ohms unbal.
BALUN	included
BOOM LENGTH	21 ft. 11 in.
F/B 20 dB F/S	30 dB
VSWR	1.5:1
WINDLOAD	1.71 sq. ft. (max.)
TURNING RADIUS	12 ft. 4 in.
WT. (lbs.)	9 lbs.

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*To provide a more accurate and consistant gain figure, performance of this KLM antenna has been carefully measured and correlated in accordance with National Bureau of Standards Note #688. This gain figure may appear somewhat conservative when compared with others commonly found in conventional industry literature and based on older, less exacting rating methods.

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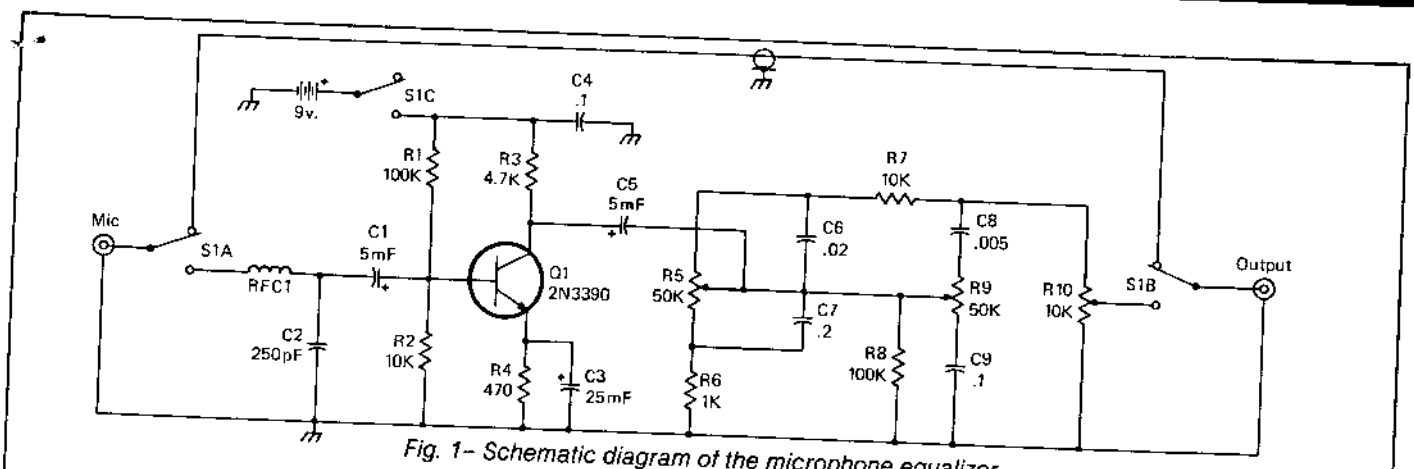
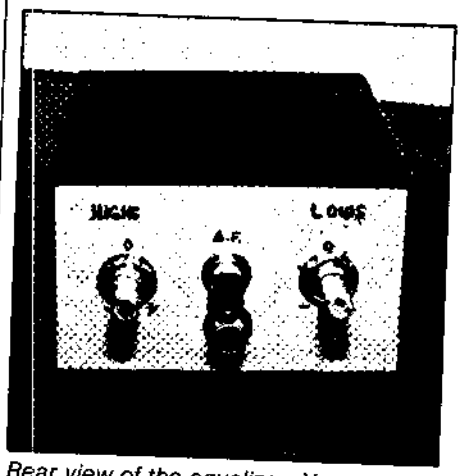


Fig. 1– Schematic diagram of the microphone equalizer.



Rear view of the equalizer. You can add knobs to the controls if you want to.

Parts List

C1, C5 4.7 μF 16 volt electrolytic or tantalum
C2 270 pF 50 volt ceramic or similar
C3 22 μF 16 volt electrolytic or tantalum
C4, C9 .1 μF 50 volt metal film, PC-mount type or similar
C6 .022 μF 50 volt metal film, PC-mount type or similar
C7 .22 μF 50 volt metal film, PC-mount type or similar
C8 .005 μF 50 volt metal film or ceramic
R1 100K ohms ¼ watt
R2 10K ohms ¼ watt
R3 4.7K ohms ¼ watt
R4 470 ohms ¼ watt
R5, R9 50K ohms carbon pot, linear taper
R6 1K ohm ¼ watt
R7 10K ohms ¼ watt
R8 100K ohms ¼ watt
R10 10K ohms, carbon pot, audio taper
S1 3-pole 2-position rotary switch
Q1 2N3390 transistor or equivalent (see text)
RFC1 miniature ferrite-core choke 300-500 μHy (not critical)
Misc. circuit board, cabinet, knobs, battery, hook-up wire, small-diameter shielded wire (RG174U coax), hardware, microphone, output jacks, etc.

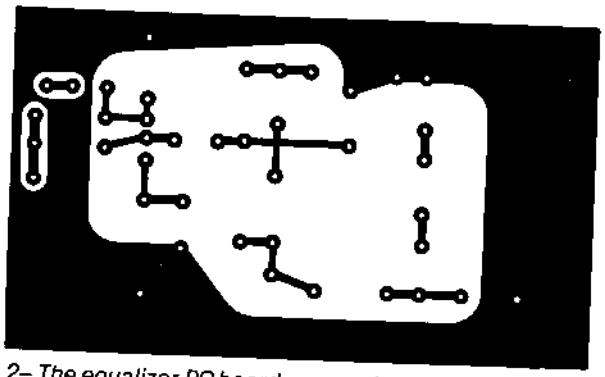


Fig. 2– The equalizer PC board as seen from the foil side. This is shown actual size.

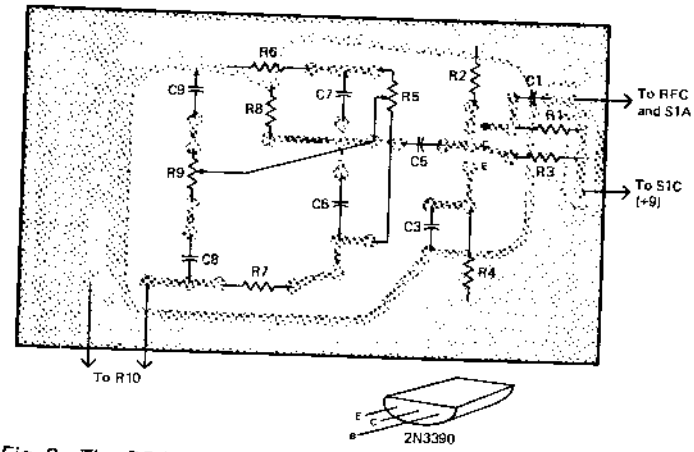
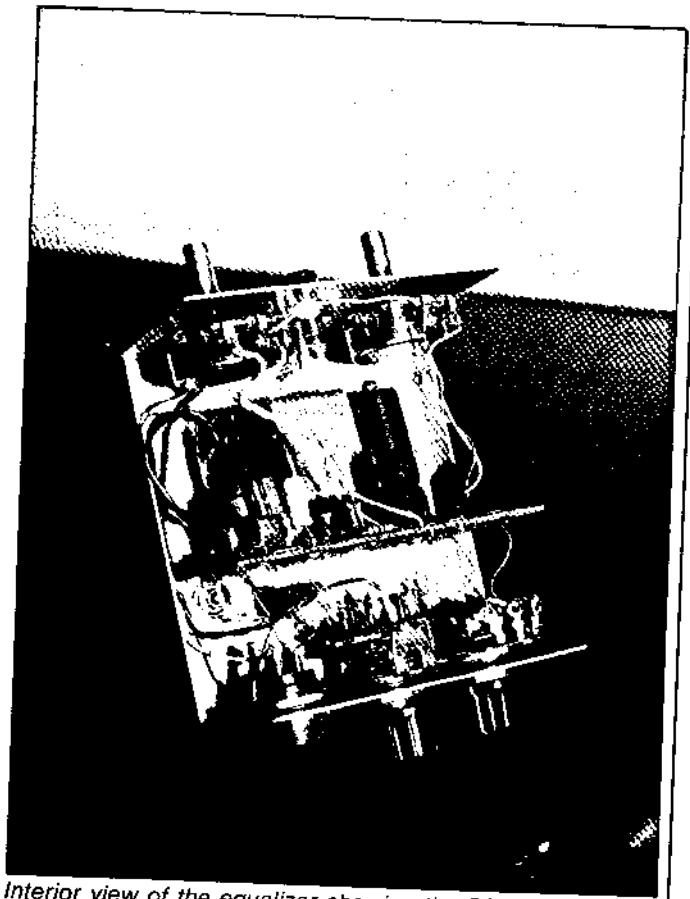


Fig. 3– The PC board shown from the component side. This is also the parts placement.



Interior view of the equalizer showing the PC board and the point-to-point construction.

provide shielding and other conveniences, but any similar metal enclosure will do.

The circuit is quite simple and requires no special precautions. I used a 1¾" by 3" piece of perforated board with point-to-point wiring. A PC circuit board can be made from the drawings if desired. The board is mounted vertically with two small brackets to save space and to provide a good mechanical and electrical connection.

The microphone jack, the **On-Off** switch, and the level or gain control were mounted on the front panel, while the bass and treble pots were mounted on the rear panel. A couple of RCA-type phono jacks—one for the output audio and the other for the microphone push-to-talk circuit—were also mounted on the rear. C1, C3, and C5 are 16 volts electrolytic or tantalum capacitors. C2 and C4 are not mounted on the board, but should be soldered on the foil side with short leads.

The network capacitors—C6, C7, C8, and C9—should be good-quality 10% mylar or ceramic capacitors. The bass and treble potentiometers should be of the linear type; be sure to connect both variable arms together, since only one wire comes from the circuit board. The 9 volt battery should be fastened to the bottom of the cabinet with a metal or plastic clamp to avoid tumbling.

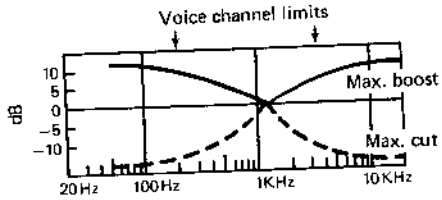


Fig. 4– Frequency response of the microphone equalizer.

Using the Equalizer

Perhaps the best way to evaluate the unit is to get the help of a friend to monitor your test transmissions. If recording capabilities are available, they should be used, and a series of well-documented tests should be made; later you can listen to the recordings and choose the desired settings. Remember that anything done at the receiving end may affect the tests.

The equalizer can be used with almost any phone transmitting equipment of modern design. It may also be used with recording or public-address systems and even with audio equipment. Make sure that all interconnecting cables are shielded to avoid hum or r.f. pick-up and that the level control is set to the proper level.

(Bibliography: *Transistor Manual*, General Electric Co.; *Radio Handbook*, Editors and Engineers; Radiotron designer, RCA; Reference data for radio engineers, ITT.)