Technicalities

SPEECH PROCESSING

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The topic for discussion this month is speech processing, the adding of 'punch' to transmitted audio.

Given the boring uniformity of modern commercial radio gear, the variation in 'received' quality of the audio constantly surprises me. Without doubt some people have a resonance of voice which accords well with the limited bandwidth transmissions used in amateur radio. Other individuals, perhaps using identical equipment, sound thin, watery and difficult to pick out of the noise or QRM.

What makes it even odder is the lack of correlation between a person's normal voice and how they sound over the air. There are operators who sound the same both on the air and face-to-face. There are others that you wouldn't even recognise when going from one medium to the other. I have rationalised the difference by assuming that the spectrum of the average person's speech is split up into discrete frequency bands with very little in between. For instance the major resonances of the vocal tract may occur in the range 200 to 300Hz, 700 to 900Hz, 1.5kHz to 1.9kHz, etc. The actual pattern will depend on the individual.

Radio equipment is designed to transmit only those frequencies which fall between 0.3 to 3kHz. I think that the reason for this will be obvious to everyone: the higher the modulation frequency, the larger are the bandwidth requirements of the radio spectrum of the transmitted signal. Furthermore it is generally held that speech frequencies outside these limits are of little value in conveying the sense of the communication. The consequence of this is that radio equipment only responds to a fairly slender speech band and if the voice pattern doesn't match with the equipment pattern, then 'thin audio' will be the perceived result.

Matching voice to equipment

What can be done about this? The short answer is that the equipment must be tailored to suit the voice pattern of the individual within the constraints of the bands of frequencies between 0.3 to 3kHz. This tailoring requires that deficient areas of the individual's speech spectrum should be boosted. The way that most people do this is swapping microphones around until they find a combination which gives the most punch to their speech. This is not particularly scientific and can get a bit expensive. It is also possible to modify microphones. For instance I use a standard Yaesu desk mic. I can't remember the model number off-hand but it is the one fitted with the goose neck. I found the mic hopelessly bassy when used with my homebrew transceiver. I effected a cure by taking out the mic capsule (the transducer element) and blocking off two of the three equaliser holes in the back of the capsule. While this action had no effect on the top end of the speech spectrum (this section was OK) it neatly tailored the bottom end to suit the charactistics of my voice and the equipment in use. Result — pretty good audio.

It illustrates a point that quite a lot can be done to improve the talk power of a signal with a fairly simple modification. I could possibly have tackled the problem by placing a relatively low value capacitor in series with the mic connection to produce the required bass rolloff.

Talk power

A much more elegant solution with wide applications would be to use a graphic equaliser. I have actually tried one of these devices in radio work and I can report that they do quite a lot for an otherwise poor signal. A graphic equaliser is a

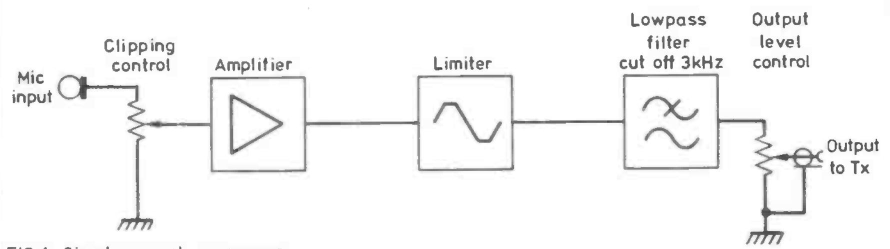

FIG. 1. Simple speech processor.

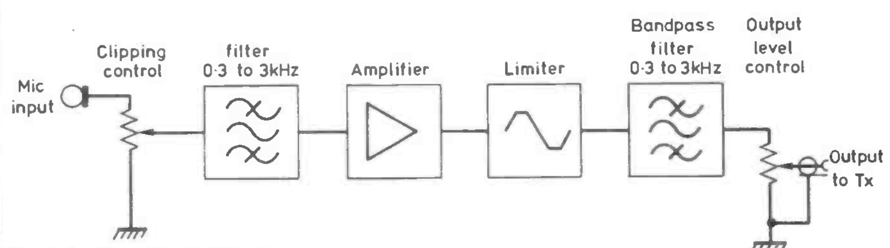

FIG. 2. Improved speech processor.