



## Speech referenced limiting of noise

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**PACS:** 43.38.Si, 43.50.Hg, 43.50.Ki, 43.60.Bf, 43.60.Dh, 43.66.Ts, 43.66.Vt

### ABSTRACT

Electronic communications equipment such as telephones, two-way radios, computers, amplified hearing protectors and hearing aids can reproduce noise with a loudness in excess of the speech they reproduce. Noise that is louder than conversational speech is typically perceived as being less comfortable and in some cases can cause injury to the listener, such as producing an acoustic shock injury or a hearing loss. The conventional approach to controlling loud noise is to use a sound level limiter however conventional sound level limiting suffers from several shortcomings. Firstly, there is always a compromise when setting a limiting level: if it is set to a high level then the listener can be subjected to loud sound; but if it is set to a low level the speech will be limited, which will reduce its quality and intelligibility. Secondly, conventional methods of sound level limiting do not adapt to the sound to which the listener is acclimatised. A new approach to sound level limiting is to use the loudness of the speech that the listener is hearing as a reference and reduce the loudness of non-speech sounds with respect to this reference. This novel method is called Speech Referenced Limiting (SRL). The limiting level is adaptive and automatically set by the loudness of the speech to which the listener is acclimatised. When done on a frequency specific basis an umpires whistle is reduced to the maximum level of the treble of a recent conversation and the rumble of a truck to the maximum level of its bass. This is achieved by estimating the maximum loudness of speech at different frequencies to produce a speech reference and limiting sound that exceeds this reference. A digital signal processing algorithm has been developed to perform the method. Details of the SRL scheme and experimental data on the effects of SRL on speech and noise are presented.

The authors acknowledge the financial support of the HEARing CRC, established and supported under the Australian Government's Cooperative Research Centres Program.