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***Abstract*--Sensorineural hearing loss is characterized by reduced frequency selectivity due to increased spectral masking. Splitting of speech into two signals by comb filters having complementary magnitude response and presenting these signals to the two ears has helped in improving speech perception for persons with bilateral sensorineural hearing loss. Investigation is carried out to improve the comb filters based on auditory critical bands, with the objective of minimizing the perceived spectral distortions. The design was carried out for obtaining reduced pass band ripple, increased stop band attenuation and better response at the crossover between adjacent bands. The filters were designed as linear phase FIR filter with magnitude responses having alternate pass and stop bands over 18 auditory critical bands. Frequency sampling technique was used for obtaining filter with the desired magnitude response. Listening tests were conducted to find difference in intensity for monaural and binaural presentations for equal loudness perception. Based on these results, 256-coefficients linear phase comb filters were designed, with pass band ripple of 1 dB, stop band attenuation of 30 dB, and crossovers adjusted to lie between 4 dB and 6 dB with respect to pass band response. A slowly swept tone presented through the comb filters showed negligible change in perceived loudness at the crossovers. Compared to filters designed with sharp transitions, the new comb filters resulted in better speech**