

Tower of power

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This article was provoked by a comment from Arun Chakraverty (STUDIO SOUND, November '76, p36) that the single 'Don't go breakin' my heart' was an example of how one could get: 'the maximum possible level on the disc without any limiting or altering the overall equalisation'. Now try putting it to air.

THE TERMS 'split-band limiting' and 'asymmetrical' limiting do not usually find their way into the vocabulary of studio engineers, but they are extremely important concepts to a broadcast engineer trying to get the maximum loudness, coverage, and audience out of his transmitter. Unless the average broadcast engineer can get the studio engineer's product through the complex system known as am radio, a record's progress up the charts may be hindered. It is essential that the studio engineer have some type of feel for what is going to happen to their product on its way to the listener's ears.

Consider the am car radio. It sells a lot of records, but it is also a device with horrible performance. Typically, one can find the frequency response at 5 kHz down by 6-15 dB referenced to 100 Hz at the radio's output terminals. This restricted response is coupled with a small speaker and a decided windshield resonance at about 100 Hz. Consider also that the final peak limiter used to protect the transmitter always looks at the highest peak content on the record, and adjusts the entire gain to that level. Now you can understand why *If you leave me now* from the *Chicago X* 1p seemed to cause the loudness level of small radios to drop considerably. The heavy bass line through the song was all that the broadcast limiters were seeing, thus keeping the key loudness and perception frequencies below their normal levels. The alternative to this phenomenon is to re-equalise the record at the radio station for most efficient transmission. The ideal is to have equal energy density across the spectrum on all material transmitted, a technique now being achieved by the more progressive broadcast engineer using three processes.

The first process is to split the audio signal into octave or 3-octave bands, gain control each band, and then recombine the bands before final limiting. This system is coming into wide use and the results are quite dramatic. The unfortunate part is that the use of these devices often alters a musical effect.

The second system is to examine in octave bands the spectral density of the disc, digitally store the information, and then display the results on a read-out device—a procedure

similar to that used in monitor equalisation. Shelf-equalisers then smooth out the total spectral density of the disc, and the re-equalised signal is recorded on a tape cartridge. When played back, the audio signal is split into high and low-frequency bands, each band being carefully controlled to achieve a continuous balance without losing musical effects. The recombined signal is then processed by the final peak limiter. The big advantage in this system is a less-controlled sound. Unfortunately every disc must be treated individually before being broadcast, and a significant amount of time is required to properly analyse and equalise each record.

The third and last system is to simply roll off the low and boost the high frequencies on all the material to be transmitted, the amount of cut and boost being determined by the characteristics of an 'average' receiver—whatever that means. More often than not, this method backfires for one reason: the high frequencies are usually boosted quite a bit, and whenever a lot of hf information (such as an 's' sound) comes along, the final limiter will cause the whole signal to 'duck' in order to prevent over-modulation.

Wouldn't it be nice not to disturb the recording engineer's idea of what is correct? Wouldn't it be nice standing in the unemployment line because the other stations sound louder, brighter, and better on the station owner's radio? We can conclude that the availability, at very reasonable cost, of digital spectrum analysers that can assist the recording engineer, makes the use of such devices in examining the final mixdown a realistic approach.

Asymmetrical modulation means simply that the transmitter is modulated with higher positive modulation than negative. In am radio, more than 100% negative modulation is impossible, since, by definition, it means no power output. If the signal is continuously modulated down to 100% negative, the transmitter generates spurious responses known as 'splatter'. Conversely, 100% positive modulation means that a peak power of four times the carrier power is being transmitted. Limiters are used to prevent negative 'over-modulation' and 'splatter'. Signals can be modulated in the positive direction as far as