tion to the track width. Technically, beyond a certain track width it becomes difficult to maintain accurate azimuth alignment.

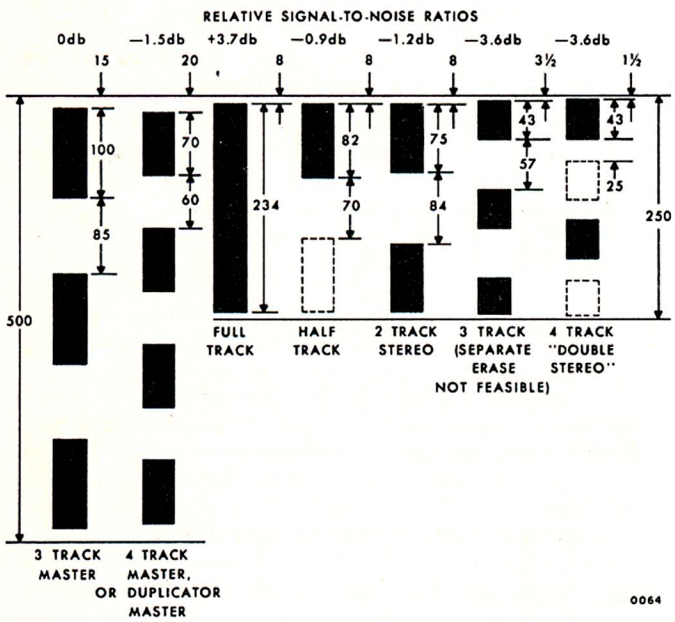
If the signal-to-noise ratio is determined by the medium itself, (the tape noise is at least 8 to 10 db above the equipment noise) then the signal-to-noise of the system is proportional to the square root of the track width.

So, just how wide should the track be? As the track width increases, closer and closer mechanical tolerances must be held to maintain the same linear alignment accuracy, which determines the azimuth alignment and therefore the high frequency response and stability. Experience has shown that, for 15 ips recording speeds, it is practical to maintain azimuth alignment for track widths up to 250 mils. (For lower speeds, say at 7½ ips, it is difficult to maintain azimuth alignment for tracks wider than 100 mils.)

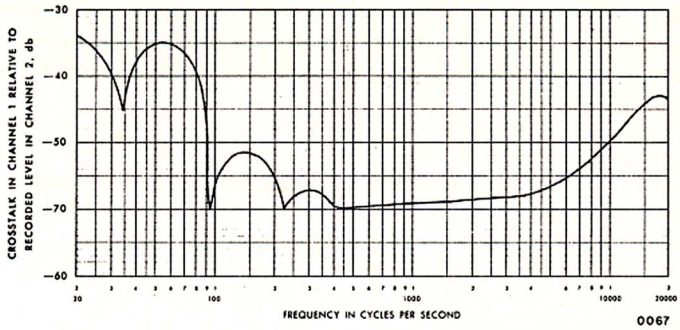
Remembering our practical economic considerations, we can put three 100 mil tracks, separated by 85 mils, on ½-inch tape (or six tracks on 1-inch tape). The three track, ½-inch, equipment is widely used in recording master tapes, and has been accepted as the best compromise between tape utilization and track width. Different configurations of track width and spacing, with the relative signal-to-noise ratios of each, are shown in an accompanying illustration.

Track Spacing

Two crosstalk effects are known to occur: At long wavelengths magnetic coupling occurs in reproduce between the signal recorded on one track and the

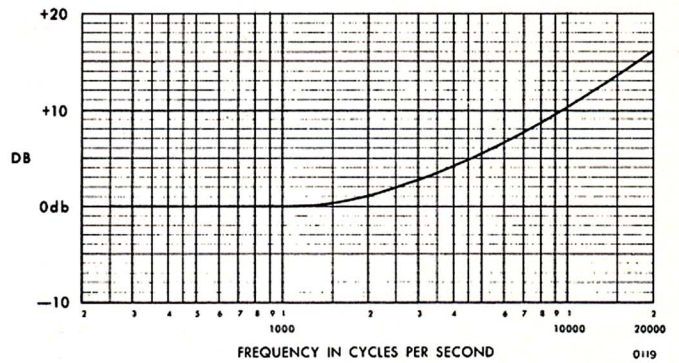


Normal record and reproduce head configurations used by Ampex, with relative signal-to-noise ratios in respect to the 100 mil track width. Dimension of six and eight track heads on 1-inch tape are the same as those shown for the three and four tracks on ½-inch tape. All dimensions are in mils.



Typical crosstalk vs. frequency curve on adjacent channels of an Ampex three channel Model 300. Channel 2 was recording at normal operating level and the record head of Channel 1 was connected. Normal bias and NAB equalization were used.

reproduce head of the other track. At high frequencies, the mutual inductance and capacitance between the two record heads causes the signal from one record head to be present in the other record head, and therefore to get recorded on that other track. Therefore spacing and shielding between cores is important in both the record and reproduce heads. Obviously the closer together the tracks the more coupling exists (assuming the same shielding). With good shielding, an 85 mil track-to-track spacing (used for Ampex ¼-inch two track, and ½-inch three track recorders) is a good compromise — more spacing to reduce crosstalk is unnecessary and would waste space, but any less would result in the increased crosstalk becoming audible above the noise.



Standard NAB post-emphasis curve for 15 ips.

Equalization

Reproduce equalization has been standardized for some time, with the curve in general use specified by the NAB (standard equalization in Europe usually follows the CCIR curve). Any pre-emphasis curve, therefore, must be tailored to the standard reproduce curve.

It is the feeling at AMPEX that the present NAB specifications are convenient curves, which give constant overall response through the tape machine using simple networks in both record and playback. The design at 15 ips has been very conservative with respect to overload capabilities, *but the signal-to-noise ratio has been inadequate.* Greater attention to the characteristics of the ear, the tape, and the music