

Recording Techniques for SQ Matrix Quadraphonic Discs*

BENJAMIN B. BAUER, GERALD A. BUDELMAN, AND
DANIEL W. GRAVEREAUX

CBS Laboratories, Stamford, Conn. 06905

This paper reports on advances in the art of mastering and editing quadraphonic records using the SQ matrix code [1]. In addition to the basic code, modulations for optimum side splits and diagonal splits are defined, and encoder circuits are illustrated for producing these special effects. Further, code variations described in the paper include "acroperiphony," or the reproduction of elevated sounds, and "extra stereophony," or a method of "folding" the back channels in the stereophonic presentation to spread their images toward and beyond the confines of the loudspeakers. The described variations are encompassed within the scope of the SQ code and are accurately decoded with all SQ decoders. These encoding refinements have led to the design of a "position encoder" which provides all the prescribed modulation forms and which can readily be integrated into a mixing console. An Appendix offers a comparative study between an SQ quadraphonic matrix Standard and another matrix Standard called Regular Matrix ("RM"), which have been adopted by the Japan Phonograph Record Association.

INTRODUCTION: Significant progress can be reported at this writing (September 1972) on the technology and practical implementation of the SQ Matrix Quadraphonic Disc System [1]. Some 100 record albums produced for this system by several record manufacturers are currently available and more than 50 models of home reproduction and decoding equipments are to be found on the domestic market and many more abroad. Popular and symphonic works are being broadcast regularly in SQ via FM multiplex for quadraphonic reception. The Engineering Committee of the Japan Phonograph Record Association (JPRA) has issued a Standard [2] covering the system.¹ Considerable advances have been introduced in the

area of mastering and editing techniques and these are the subject of this paper.

BASIC SQ MODULATIONS

The basic modulations of an SQ record are summarized below: Fig. 1a shows the motions of a disc cutter (or pickup) stylus tip produced with the application of various directional signals to an SQ encoder. It is seen that the Left-Front (L_F), Right-Front (R_F) and Center-Front (C_F) signals result in modulation vectors which correspond exactly with the Left, Right, and Center modulations of a standard stereophonic record, thus retaining full front channel separation and identity with stereo for all stage-front sounds. The Left-Back (L_B) signal results in a clockwise motion, and the Right-Back (R_B) signal in a counterclockwise motion of the stylus, which, with forward translation generate two oppositely directed helical modulations along the groove. The Center-Back (C_B) signal defines a vertical modulation, which is indicated in broken line. Since vertical modulation is

* * Presented September 14, 1972 at the 43rd Convention of the Audio Engineering Society, New York.

¹ Another matrix system, called "Regular Matrix" or "RM," also has been standardized by JPRA. Relationships between SQ and RM are described in the Appendix at the end of this paper.