

Before the
Federal Communications Commission
Washington, D.C. 20554

ET Docket No. 92-298

In the Matter of

Amendment of the Commission's
Rules to Establish a Single AM
Radio Stereophonic Transmitting
Equipment Standard

NOTICE OF PROPOSED RULE MAKING

Adopted: December 10, 1992; Released: January 6, 1993

Comments Due: April 5, 1993

Reply Comments Due: April 20, 1993

By the Commission:

INTRODUCTION

1. By this action, the Commission is proposing to adopt a standard for stereophonic AM broadcast radio service, specifically, the Motorola C-Quam system. This proposal responds to Section 214 of the Telecommunications Authorization Act of 1992 (Authorization Act), which requires the Commission to adopt a single AM broadcasting stereo transmission standard.¹

BACKGROUND

2. *Telecommunications Authorization Act.* On October 27, 1992, the President signed the Authorization Act into law. Section 214 of the Authorization Act states that the Federal Communications Commission shall -

(1) within 60 days after the date of enactment of this Act, initiate a rulemaking to adopt a single AM radio stereophonic transmitting equipment standard that specifies the composition of the transmitted stereophonic signal; and

(2) within one year after such date of enactment, adopt such a standard.

3. *AM Broadcasting Stereo Transmission Standards Developments.* In 1982 the Commission authorized AM stations to offer stereo service.² The Commission declined to select a single system standard from among the five competing AM stereo technical systems.³ Rather, the Commission concluded that it would be more effective and efficient to allow market forces to determine the course of AM stereo development. Shortly afterwards, the field narrowed to two systems: Motorola's C-Quam system and the Kahn system.⁴

DISCUSSION

4. Of the approximately 660 US AM broadcasting stations that have converted to AM stereo, 591 use the Motorola system and an additional 37 use the Harris Corporation C-Quam compatible system.⁵ Fewer than 20 stations now employ the Kahn system. Twenty-six receiver manufacturers incorporate the Motorola system in at least one model; none incorporate the Kahn system. There are approximately 24 million Motorola C-Quam receivers currently in use by radio listeners. In the mid-80s, approximately 280,000 receivers were made that could decode both the Motorola and Kahn signals. These multi-mode receivers, however, are no longer produced. The Motorola system has been adopted as the national standard in six foreign countries: Canada, Mexico, Australia, Brazil, South Africa, and Japan. No countries have adopted the Kahn system.

5. The Authorization Act requires that we establish a single AM stereo standard. In light of the data presented above, particularly the figures regarding receiver types, we believe the public interest would be best served by adopting the Motorola C-Quam system as the U.S. AM stereo standard. Broadcasters, manufacturers and radio purchasers have, directly or indirectly, demonstrated strong preference for the Motorola system. Adoption of the C-Quam system as the AM stereo standard would eliminate the remaining uncertainty with regard to the AM technology broadcasters should employ and thereby serve to promote expansion of AM stereo transmitting equipment and a corresponding improvement in the quality of the AM service.

6. We believe that selection of an alternative to the Motorola system would set back the clock on the implementation of AM stereo service, to the substantial detriment of the public and broadcasters. Specifically, the users of the existing 24 million C-Quam receivers would no longer be able to enjoy AM stereo reception through that equipment. Also, existing AM broadcasters would forfeit their investments in C-Quam transmission equipment.

¹ See Telecommunications Authorization Act of 1992, Pub. L. No. 102-538. This proceeding is limited to issues involved in implementation of Section 214 of the Authorization Act. Other provisions of the Authorization Act are being addressed elsewhere.

² See *Report and Order* in Docket No. 21313, adopted March 4, 1982, 47 FR 13152.

³ The developers of these AM stereo systems were Belar Electronics Corp., Harris Corporation, Kahn Communications, Inc./Hazeltine Corporation (the Kahn system), Magnavox Corporation, and Motorola Corporation.

⁴ In 1988, the Commission reaffirmed its earlier decision not to select a standard. In that action, the Commission noted that the

market appeared to be working towards establishing a *de facto* standard. See *Memorandum Opinion and Order*, 3 FCC Rcd 403 (1988).

⁵ The statistics and other information cited herein are taken from testimony and comments to the Hearing before the Subcommittee on Communications, of the Committee on Commerce, Science, and Transportation, United States Senate, March 11, 1992, S. Hrg. 102-740. Copies of the relevant information is being inserted in the record for this proceeding. See, in particular, the Prepared Statement of Bruce Ladd, Vice President of Government Affairs and Government Relations, Motorola, Inc.

Further, we are aware that many AM broadcasters are struggling financially and may not be able to afford replacement stereo transmission equipment. Selection of an alternative stereo standard thus could conceivably result in discontinuance of the existing stereo service with no replacement. Such a result would be inconsistent with the legislative intent to advance AM stereo service. In light of these factors, proponents of alternative standards would bear a heavy burden to show that the potential benefits of an alternative technology outweigh the likely costs and delays of selection of a standard different than the Motorola system. Nevertheless, we invite comment on alternatives to the proposed standard.⁶

7. We are proposing to incorporate the Motorola C-Quam standard in Part 73 of our rules. The proposed standard is presented in Appendix B. We are also proposing to require stations that employ alternative AM stereo systems (*i.e.*, the Kahn and Harris systems) to discontinue such operation as of one year from the effective date of these rules.⁷ Any stations converting to AM stereo after the effective date of these rules will be required to employ the system adopted by the Commission. Consistent with our general policies towards improvement of the AM broadcasting service, we will continue to encourage the availability of AM receivers, including AM stereo receivers, that meet appropriate quality standards.⁸

PROCEDURAL MATTERS

8. *Ex Parte Rules - Non-Restricted Proceeding.* This is a non-restricted notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during the Sunshine Agenda period, provided they are disclosed as provided in Commission rules. See generally 47 C.F.R. Sections 1.1202, 1.1203 and 1.1206(a).

9. *Comment Information.* Pursuant to procedures set forth in Sections 1.415 and 1.419 of the Commission's rules, interested parties may file comments on or before April 5, 1993, and reply comments on or before April 20, 1993. Extensions of these time periods are not contemplated. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. To file formally, participants must file an original and four copies of all comments, reply comments, and supporting comments. If participants want each Commissioner to receive a personal copy of their comments, an original plus nine copies must be filed. Comments and reply comments should be sent to the Office of the Secretary, Federal Communications Commission, Washington, DC 20554. Comments and reply comments will be available for public inspection during regular business hours in the FCC Reference Center (Room 239) of the Federal Communications Commission, 1919 M Street, N.W., Washington, DC 20554.

10. *Regulatory Flexibility Act.* As required by Section 603 of the Regulatory Flexibility Act, the FCC has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the ex-

pected impact of these proposed policies and rules on small entities. The IRFA is set forth in Appendix A. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments on the rest of the *Notice*, but they must have a separate and distinct heading designating them as responses to the regulatory flexibility analysis. The Secretary shall cause a copy of the *Notice*, including the IRFA, to be sent to the Chief Counsel for Advocacy of the Small Business Administration in accordance with Section 603(a) of the Regulatory Flexibility Act (Pub. L. No. 96-354, 94 Stat. 1164, 50 U.S.C. Sections 601 *et seq.* (1981)).

11. *Additional Information.* For further information concerning this proceeding, contact David Means, Engineering Evaluation Branch, Office of Engineering and Technology, (301) 725-1585.

FEDERAL COMMUNICATIONS COMMISSION

Donna R. Searcy
Secretary

APPENDIX A INITIAL REGULATORY FLEXIBILITY ANALYSIS

Reason for Action. This proceeding is being initiated to select an AM radio stereophonic equipment standard, as required under Section 214 of the Telecommunications Authorization Act of 1992.

Objectives. The Commission's goal is to select an AM stereophonic transmission standard.

Legal Basis. Authority for this proposed rule making is contained in Section 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 154(j), and 303(r) and Section 214 of the Telecommunications Authorization Act of 1992, Pub. L. 102-538 (1992).

Reporting, Recordkeeping and other Compliance Requirements. AM stereo transmission equipment would require type acceptance by the FCC to demonstrate compliance with the proposed standard.

Federal Rules the Overlap, Duplicate or Conflict with Proposed Rule. None.

Description, Potential Impact, and Number of Small Entities Involved. This action is expected to expand the operation of AM stereo service & sales of AM stereo receivers. The effect of this proposal would be to necessitate conversion to use of the C-Quam transmission system by approximately 50 AM stations currently using the Kahn or Harris systems in order to continue to provide stereo service.

⁶ We recognize that efforts are under way to develop digital broadcasting technologies for the AM broadcast band. The Authorization Act is clearly intended to address an AM stereo standard within the context of the current analog transmission format. Accordingly, AM digital broadcasting technologies are outside the scope of this proceeding.

⁷ We understand that the Harris system may be compatible with the Motorola C-Quam system. We invite comment as to

the extent of the compatibility and whether we should permit stations currently using the Harris system to continue to do so indefinitely.

⁸ We are taking a similar approach with implementation of advanced television (ATV). See Advanced Television Systems, 7 FCC Rcd 3340, 3358 (1992). Cf. FCC Public Notice, Revised Patent Procedures of the Federal Communications Commission, Public Notice 13948, December 6, 1961.

Any Significant Alternatives Minimizing the Impact on Small Entities Consistent with the Stated Objectives. None.

APPENDIX B

PROPOSED RULE CHANGES

I. Part 73 of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

PART 73 - RADIO BROADCAST SERVICES

1. The authority citation in Part 73 continues to read:

AUTHORITY: 47 U.S.C. 154, 303.

2. Subpart A is amended by revising section 73.128 to read as follows:

Section 73.128 AM Stereophonic Broadcasting.

(a) An AM broadcast station may, without specific authority from the FCC, transmit stereophonic programs upon installation of type accepted stereophonic transmitting equipment and the necessary measuring equipment to determine that the stereophonic transmissions conform to the modulation characteristics specified in paragraphs (b) and (c) of this section.

(b) The following limitations on the transmitted wave must be met to insure compliance with the occupied bandwidth limitations, compatibility with AM receivers using envelope detectors, and any applicable international agreements to which the FCC is a party:

(1) * * *

(c) Effective (insert date one year after enactment), stereophonic transmissions shall conform to the following additional modulation characteristics:

(1) The audio response of the main (L+R) channel shall conform to the requirements of the ANSI/EIA-549-1988, NSRC-1 AM Preemphasis/Deemphasis and Broadcast Transmission Bandwidth Specifications (NRSC-1).

(2) The left and right channel audio signals shall conform to frequency response limitations dictated by ANSI/EIA-549-1988.

(3) The stereophonic difference (L-R) information shall be transmitted by varying the phase of the carrier in accordance with the following relationship:

$$\phi_c = \tan^{-1} \left(\frac{m(L(t) - R(t))}{1 + m(L(t) + R(t))} \right)$$

where:

L(t) = audio signal left channel,

R(t) = audio signal right channel,

m = modulation factor, and

$m_{\text{peak}}(L(t) + R(t)) = 1$ for 100% amplitude modulation,

$m_{\text{peak}}(L(t) - R(t)) = 1$ for 100% phase modulation

(4) The carrier phase shall advance in a positive direction when a left channel signal causes the transmitter envelope to be modulated in a positive direction. The carrier phase shall likewise retard (negative phase change) when a right channel signal causes the transmitter envelope to be modulated in a positive direction. The phase modulation shall be symmetrical for the condition of difference (L-R) channel information sent without the presence of envelope modulation.

(5) Maximum angular modulation, which occurs on negative peaks of the left or right channel with no signal present on the opposite channel (L(t) = -0.75, R(t) = 0, or R(t) = -0.75, L(t) = 0) shall not exceed 1.25 radians.

(6) A peak phase modulation of +/- 0.785 radians under the condition of difference (L-R) channel modulation and the absence of envelope (L+R) modulation and pilot signal shall represent 100% modulation of the difference channel.

(7) The composite signal shall contain a pilot tone for indication of the presence of stereophonic information. The pilot tone shall consist of a 25 Hz tone, with 1% or less total harmonic distortion and a frequency tolerance of +/- 0.1 Hz, which modulates the carrier phase +/- 0.05 radians peak, corresponding to 5% L-R modulation when no other modulation is present. The injection level shall be 5%, with a tolerance of +1, - 0%.

(8) The composite signal shall be described by the following expression:

where:

A = the unmodulated carrier voltage

m = the modulation index

C_{sn} = the magnitude of the nth term of the sum signal

C_{dn} = the magnitude of the nth term of the difference signal

ω_{sn} = the nth order angular velocity of the sum signal

ω_{dn} = the nth order angular velocity of the difference signal

$$E_c = A_c \left[1 + m \sum_{n=1}^{\infty} C_{sn} \cos(\omega_{sn} t + \phi_{sn}) \right] \cos \left[-\omega_c t + \tan^{-1} \frac{m \sum_{n=1}^{\infty} C_{dn} \cos(\omega_{dn} t + \phi_{dn}) + .05 \sin 50 \pi t}{1 + m \sum_{n=1}^{\infty} C_{sn} \cos(\omega_{sn} t + \phi_{sn})} \right]$$

ω_c = the angular velocity of the carrier

$$\phi_{sn} = \text{the angle of the } n\text{th order term} = \tan^{-1} \left[\frac{B_{sn}}{A_{sn}} \right]$$

$$\phi_{dn} = \text{the angle of the } n\text{th order term} = \tan^{-1} \left[\frac{B_{dn}}{A_{dn}} \right]$$

A_{sn} and B_{sn} are the n^{th} sine and cosine coefficients of C_{sn}
 A_{dn} and B_{dn} are the n^{th} sine and cosine coefficients of C_{dn}