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

REPORT AND ORDER
(Proceeding Terminated)

Adopted: October 25, 1993; Released: November 23, 1993

By the Commission:

INTRODUCTION

1. By this action, the Commission adopts a standard for stereophonic AM broadcast radio service, specifically, the Motorola C-Quam system. Our establishment of an AM stereo standard is intended to remove any remaining uncertainty among AM broadcasters as to which stereo system to use and thereby encourage the improvement and expansion of AM broadcast service. This action 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. In 1982 the Commission authorized AM stations to offer stereo service.[2] At that time, 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 afterwords, the field of competition narrowed to two systems: the Motorola "C-Quam" system and the Kahn system.[4] Some of the Harris AM stereo systems sold before the Harris Corporation dropped out of the competition also remain in service.

3. 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 a year after such date of enactment, adopt such a standard.

4. On December 10, 1992, in response to the Authorization Act, the Commission adopted a *Notice of Proposed Rule Making (Notice)* in this proceeding which proposed to adopt the Motorola C-Quam system as the AM stereo standard.[5] Comments and/or replies responding to the *Notice* were filed by 27 parties.

DISCUSSION

5. In the *Notice*, we proposed to adopt the Motorola C-Quam system as the AM stereo standard in view of the fact that this system appears to have become the *de facto* choice of the market. We observed that this system has become by far the predominant choice of AM stations choosing to convert to stereo, there are large numbers of existing receivers capable of decoding only C-Quam and receivers for other systems are generally unavailable.[6] We also noted that the Motorola system has been adopted as the national standard in six other countries,[7] while none had adopted the Kahn system. We further indicated our belief that selection of an alternative system as the standard would set back the clock on the implementation of AM stereo service. We therefore stated that proponents of alternative systems would bear a heavy burden to show that the potential benefits of an alternate technology would outweigh the likely costs and delays of selection of a standard different than the Motorola system. Nevertheless, we invited submission of alternatives to the proposed standard.

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[1] *See* Telecommunications Authorization Act of 1992, P. 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 an AM stereo 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] *See Notice of Proposed Rule Making,* 3 FCC Rcd 688 (1993).

[6] In the *Notice* we observed that, of the approximately 660 US AM broadcasting stations that have converted to stereo operation, 591 use the Motorola system, an additional 37 use the Harris C-Quam compatible system, and somewhat fewer than 20 employ the Kahn system. We further noted that there are approximately 24 million C-Quam receivers currently in use, and that approximately 280,000 multi-system receivers were manufactured in the mid-80s. Multi-system AM stereo receivers are no longer produced. These statistics were 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. *See,* in particular, the Prepared Statement of Bruce Ladd, Vice President of Government Affairs and Government Relations, Motorola, Inc.

[7] Other countries adopting the Motorola system as their AM stereo standard include Canada, Mexico, Australia, Brazil, South Africa, and Japan.

We aiso proposed to require stations currently employing the Kahn or Harris stereo systems to discontinue operations with those systems within one year of the effective date of the new rules. We sought comment on the degree of compatibility of the Harris system with the C-Quam system and whether stations using that system should be permitted to continue to do so indefinitely.

6. *Selection of the AM Stereo Standard.* The National Association of Broadcasters (NAB), the Consumer Electronics Group of the Electronic Industries Association (EIA/CEG), the majority of broadcast equipment manufacturers who filed comments,[8] and others,[9] strongly support our proposal to select the Motorola C-Quam system as the AM stereo standard. Motorola states that the proposed action is consistent with Congress' expressed legislative intent to advance AM stereo service, and that adoption of the C-Quam system as the standard will benefit AM listeners by encouraging the availibility of more AM stereo receivers and transmitting facilities, thereby providing the public with higher quality AM broadcasts.

7. The NAB agrees with our observation that only the Motorola system has achieved any significant market penetration. It observes that the adoption of the same system in this country as has been adopted in other countries, particularly Japan, will allow economies of scale to be realized by commercial manufacturers with benefits for all broadcasters and consumers. The NAB and the EIA/CEG state that the greater certainty provided by the Commission's selection of a single system for AM stereo will be welcome by both broadcasters and consumer receiver manufacturers. The EIA/CEG maintains that receiver manufacturers and broadcasters heretofore have been fearful of guessing wrong in selecting among competing AM stereo technologies. The EIA/CEG further points to the success of the adoption of the Motorola system as the standard in Japan in encouraging the wide availability of AM stereo reception capabilities there in both auto and home receivers from a variety of manufacturers.

8. Comments opposing the selection of the C-Quam system were submitted by the two principal proponents of the Kahn system, Leonard R. Kahn and the Hazeltine Corporation (Hazeltine), as well as several broadcast consulting engineering firms and individual consultants and broadcast station engineers. Kahn maintains that the Motorola system exhibits serious technical flaws, including "platform motion",[10] loss of coverage, and increased interference to neighboring adjacent channel stations. A number of parties from the broadcast engineering community[11] echo Kahn's assertion that the Motorola system exhibits technical flaws, and further assert that the Kahn system has been demonstrated to be technically superior to the Motorola system. Several parties[12] suggest that further testing of of the competing systems is necessary to determine the relative technical merits before a decision on a standard is made.

9. Several parties, including Capital Cities/ABC, Inc. (Cap Cities/ABC), Hershberger, and James Dorrence, assert that the selection of an AM stereo system should be based primarily on technical considerations and that the Commission should choose a standard that would implement the best possible technology. These parties generally argue that the Commission should investigate other alternatives to the Motorola and Kahn systems. Cap Cities/ABC favorsadoption of a standard broad enough to allow for the play of competitive forces to foster quality improvements. Hershberger favors a linear independent sideband system as the ultimate standard, with the Kahn system as an interim standard. Dorrence recommends a single-sideband system and presents performance goals for such a standard.

10. Kahn challenges Motorola's market share statistics, arguing that Motorola's market share was captured by unfair competition, and that the Commission should discount the current use of the Motorola system as a true indication of market acceptance. Kahn also claims that the Commission may not adopt the Motorola system as the AM stereo standard without obtaining and reviewing the documents submitted (but then voluntarily withdrawn) by Kahn regarding allegations of antitrust activities.[13] Hazeltine echoes Kahn's anticompetitive charges against Motorola. In this

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[8] These parties include Motorola, Inc., Broadcast Electronics, Inc. (BE), Delta Electronics, Inc. (Delta), and Harris Corporation's Harris Allied Broadcast Division (Harris).

[9] Peter Kraushar and Paloma Blanca Radio, Ltd. (Paloma).

[10] "Platform motion" is a term used to describe a deterioration of the received signal under weak signal, multipath, or interference conditions which manifests itself as a shifting of the stereo image between the two channels in an uncontrolled and unpredictable manner.

[11] The parties claiming the technical superiority of the Kahn system are: Communications Technologies, Inc. (CTI), David L. Hershberger, Lee Sutherland Parr, David H. Solinske, Rich Wood, John E. Morris, Warren G. Smith, and Titus Technological Laboratories (Titus).

[12] Parties suggesting further testing are: Philip E. Galasso, Hazeltine, Kahn, Smith, Solinske, Jules Cohen & Associates (Cohen), E. Harold Munn, Jr., Cohen Dipell and Everist (CDE), Christopher Hayes, Steven L. Karty, and Philip J. Lerza.

[13] These anticompetitive allegations against Motorola were the subject of a request by Kahn that the Commission consider, but withhold from public disclosure, certain documents that were originally appended to Kahn's comments and reply comments, but then returned to Kahn at his request. The documents at issue were obtained in the course of discovery in a separate judicial proceeding between Kahn and Motorola that is pending in the Eastern District of New York. Because the documents are subject to a confidentiality order issued by the court, Kahn requested an "advance ruling" that the documents (which are not before the Commission and have not been reviewed by the Commission) would be afforded confidential treatment once filed with the Commission. By letter dated August 10, 1993, the Chief Engineer determined that, under the Freedom of Information Act (FOIA), the Commission could not guarantee that the documents at issue would be withheld from public inspection simply because they are the subject of a confidentiality order to which the FCC was not a party. Kahn argues, in an application for review, that the Chief Engineer erred in denying its request for an advance ruling that the documents would be kept confidential. Specifically, Kahn asserts that the documents at issue should be afforded confidential treatment under FOIA Exemption 4, 5 U.S.C. § 552(b)(4), and the legal precepts set forth in *Critical Mass Energy Project v. NRC*, 975 F.2d 871 (D.C. Cir. 1992) (en banc), *cert. denied*, 113 S. Ct. 1579 (1993). In *Critical Mass*, the court afforded categorical protection under exemption 4 to any information that is voluntarily submitted to an agency and not customarily disclosed to the public by the submitter. In this connection, Kahn argues that the Commission should presume that the parties to the Kahn-Motorola judicial proceeding "would 'customarily' obey the judicial non-disclosure orders." We need not determine whether Kahn is correct

regard, Hazeltine argues that the broadcasters who have converted to stereo, equipment manufacturers, and radio purchasers have not, as the Commission indicated in the *Notice,* expressed a preference for the Motorola system because they did not have a free choice among alternatives. Hazeltine alleges that this lack of choice sprang from manipulation of the receiver stereo decoder integrated circuit industry by Motorola.

11. Kahn proposes that the Commission select the Kahn system as the standard, allow Kahn Communications, Inc., to provide conversion kits to stations currently employing Motorola or Harris equipment, and allow broadcasters to transmit either a 15 Hz or 25 Hz pilot tone.[14] Kahn contends that this proposal, which he describes in an *ex parte* presentation[15] as a "win - win solution," would accommodate all broadcasters who have invested in stereo transmitting equipment and provide acceptable, if not true stereo, reception on existing stereo receivers that are not designed for the Kahn system.

12. We continue to believe that the Motorola C-Quam system is the appropriate choice for the AM stereo standard. This system has proven to be technically acceptable for providing excellent quality AM stereo service at a price that is affordable to both broadcasters and consumers. We disagree with Kahn and other opposing parties that the Motorola system has serious technical deficiencies. With regard to the claim that the Motorola system suffers from platform motion and reduced coverage, we observe that recent improvements in receiver design mitigate such effects.[16] Moreover, we note that the alleged technical deficiencies of the Motorola system are largely related to weak signal reception that occurs beyond a station's protected service area and are therefore irrelevant. Moreover, we note that the Motorola and Kahn systems have been tested and comparatively evaluated extensively over the years, including recent tests conducted by other nations considering adoption of a standard. Both systems have technical advantages and disadvantages. We have no reason to expect that further testing would reveal any new information. Moreover, any further testing would surely lead to additional delays. Congress has made clear its intent that we bring this matter to a prompt resolution as indicated by the statutory time restrictions on this proceeding.

13. We reject the premise that our decision on an AM stereo standard should be based solely on technical performance, particularly at this relatively late stage of the implementation of AM stereo. We believe it is entirely appropriate that we take into account the strong preference demonstrated in the market place for the Motorola system. We note that the market place takes into account not only technical parameters, but also other factors such as subjective performance, costs of broadcasters' initial conversion to stereo, reliability, service, ease of receiver design and performance, etc. We also believe it is incumbent upon us to consider the sunk costs in existing stereo transmission equipment, compatibility with millions of existing envelope detector receivers, and availability of compatible stereo receivers, as well as the potential for obsoleting the public's investment in existing stereo receivers. In this regard, we find that selection of a system other than Motorola's would result in substantial costs to broadcasters and consumers, and thus would be detrimental to the expansion of AM stereo service. We also do not agree that we should seek development of alternatives to the Kahn and Motorola systems. To do so would introduce significant delay and confusion without any assurance that a significantly better alternative could or would be forthcoming.

14. We observe that while Kahn challenges Motorola's market penetration statistics, no alternative information is provided.[17] Kahn's contention that the limited penetration of AM stereo to date represents a rejection of the Motorola system by the majority of the AM broadcast industry is simply convoluted logic. To properly draw such a conclusion, it would be necessary to demonstrate that Motorola controlled the market for AM stereo and that its system was so inferior that broadcasters simply chose to do without AM stereo rather than accept the Motorola technology. Neither of these premises appears correct. It is obvious that other factors, such as a station's decision whether to convert to stereo at all because of the nature of its program-

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in claiming that the documents are entitled to protection under FOIA Exemption 4 and *Critical Mass.* Even if the documents were entitled to such protection, the Commission, in accordance with its rules, cannot guarantee in advance that public interest considerations presented in a subsequent FOIA request would not warrant disclosure of the documents at issue. *See* 47 C.F.R. §§ 0.459(b); 0.461(f)(4). We further note that, because the Commission is not a party to the confidentiality order issued by the court, the order does not bind the Commission and thus is not a basis for denying an FOIA request for the documents at issue. Accordingly, we find that the Chief Engineer's denial of the confidentiality request was appropriate and affirm that decision.

[14] These pilot tones cause the stereo indicator light to illuminate on an AM stereo receiver and activate the stereo decoder circuitry. A 15 Hz pilot tone will activate the decoder circuitry on a receiver designed to receive the Kahn system, and a 25 Hz tone will activate the decoder circuitry on a receiver designed to receive the Motorola system.

[15] *See Ex Parte* presentation of Leonard R. Kahn, June 19, 1993.

[16] Receivers can compensate for platform motion by reducing the channel separation under weak signal conditions. Reduction in coverage area can be eliminated by designing the receiver to smoothly transition to monaural operation when signals are weak.

[17] Although the market statistics cited in the *Notice* were taken from Motorola testimony to the US Senate Subcommittee on Communications, and their accuracy has been challenged by Kahn and others, they constitute the only tabulations of current AM station stereo operation and stereo receiver production that were available at the time of the drafting of the *Notice.* Motorola's statistics on C-Quam conversions are, according to their reply comments, based on mail surveys in 1988 and 1991 that were subsequently updated by telephone contacts. The statistics on the use of other systems are based on telephone surveys. Motorola's estimates of receiver production are based on manufacturers reports of decoder IC units shipped. Motorola admits that it is difficult to track how many of the receivers produced worldwide have been shipped to the US, but estimates that 2 to 4 million have been consumed in the Japanese home market. Motorola argues that its estimates are conservative and frequently updated. Motorola's figures remain the only data available, and, despite unsupported challenges to their accuracy, no party to this proceeding has produced alternative statistics indicating substantial errors in Motorola's data. Kahn claims to have sold 200 Kahn system stereo exciters, but offers no evidence as to how many are currently in use in stereophonic operation. He also notes the presence of the Kahn system pilot tone on eleven New York City stations, but absent any identification of these stations in Kahn's comments, there is no way to determine whether the stations are broadcasting in stereo or are using Kahn exciters in a monophonic mode of operation.

ming, economic considerations, or general uncertainty about which stereo system to use have affected AM stations' decisions on implementing stereo service. Based on the materials in the record, we are not persuaded that Motorola unfairly manipulated the marketplace to deny any segment of industry or the public a free choice. Further, we disagree with Kahn's contention that the Commission may not adopt the Motorola system standard without obtaining and reviewing the documents submitted (but then voluntarily withdrawn) by Kahn regarding allegations of antitrust activities. Allegations of anticompetitive behavior most commonly arise in the context of considering the character qualifications of mass media licensees and applications for license. In that context, we indicated that we would generally consider only adjudicated violations of antitrust or anticompetitive laws.[18] We determined further that we would consider mere allegations of "non-FCC" misconduct, such as allegations of anticompetitive practices, in circumstances in which the alleged conduct is so egregious as to shock the conscience.[19] In this case, Kahn's allegations of anticompetitive activities by Motorola are already the subject of a separate judicial proceeding. We believe it is inappropriate for the Commission to separately adjudicate these matters, which fall within the expertise of the court. Moreover, Kahn's allegations do not rise to the level of egregiousness that would warrant our independent investigation of these anticompetitive charges. Rather, to the extent Kahn (or others) believe that any adjudications by the court in the litigation are relevant, he may bring the adjudication to our attention for consideration of whether any possible Commission action at that time is warranted.[20]

15. We are also not persuaded that Kahn's proposed plan for implementing his system presents any advantages to the AM broadcast industry or the listening public. As indicated above, we are not persuaded that the Kahn system would constitute a better choice than the Motorola system even if there were no embedded base of AM stereo equipment. We also agree with Motorola[21] [22] that attempting to force C-Quam receivers to decode Kahn system signals by transmitting the 25 Hz pilot will likely cause degraded reception and will certainly cause loss of true stereo imaging. This would unacceptably and unfairly penalize the millions of consumers who have purchased C-Quam receivers.

16. We believe that the past nearly twelve years of unrestricted competition between the systems has given the public and the broadcast and receiver industries the opportunity to weigh the known technical performance considerations against other factors and to make appropriate personal and business decisions. We find that there has indeed been a convergence in the marketplace during these years toward the Motorola C-Quam system. Based on the overwhelming marketplace preference for the Motorola C-Quam system, and the long history of tests of this system, we believe the Motorola system will provide excellent AM stereo service. Accordingly, we conclude that the public interest is best served by adopting the Motorola C-Quam system as the AM stereo standard.

17. *Receiver Standards.* Several of the commenting parties, including Cap Cities/ABC, CDE, CTI, Dorrence, and Morris, argue that, in order for this proceeding to have a positive effect on the state of the AM broadcast service, the Commission must not only specify a transmitting standard for AM stereo, but must also set standards for receiver performance. The EIA/CEG points out, however, that the Authorization Act does not address the design of AM radio receivers. In its reply comments, the EIA/CEG further maintains that comments requesting receiver standards are beyond the scope of this proceeding, and points out that the Commission has previously rejected proposals to regulate AM receiver characteristics. The NAB acknowledges the our encouragement of the availability of high-quality receivers expressed in the *Notice*, and urges that we continue to expand our AM improvement efforts in conjunction with the ongoing efforts of broadcasters and receiver manufacturers.

18. We agree with the EIA/CEG that regulation of receivers is beyond the scope of this proceeding. Proposals for such regulation have been previously fully explored in past rule makings, and the Commission has chosen to continue to let the marketplace set AM receiver standards.[23] We recognize the receiver industry's efforts to date to improve the quality of AM receivers, and will continue to encourage receiver manufacturers to develop and market receivers that comply with the AMAX standards and certification program developed jointly by, the NAB and EIA/CEG.[24]

19. *Harris System Compatibility with C-Quam and Transition Period.* As indicated above, we proposed a one-year transition period for implementation of the new standard. We also sought comments on whether stations employing the Harris system were sufficiently compatible with C-Quam to continue using the Harris system indefinitely. BE

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[18] *See Report, Order and Policy Statement Regarding Character Qualifications in Broadcast Licensing* (*Character Policy Statement)* , 102 F.C.C. 2d 1179, 1204-1205 (1986), *recon. denied,* 1 FCC Rcd. 421, 422 (1986).

[19] *See Character Policy Statement,* 102 F.C.C. 2d at 1205 n.60. Although the selection of an AM stereo standard is not a licensing proceeding, we believe it is not appropriate to establish here a separate and different set of principles to examine Kahn's allegations. Thus, we have considered Kahn's anticompetitive charges against Motorola under the guidance established in our policy statements regarding broadcasters' character.

[20] On October 8, 1993, Mr. William Malone, attorney for Mr. Kahn, transmitted a copy of a memorandum decision of Judge Arthur D. Spatt in Mr. Kahn's suit against Motorola before the Eastern District of New York. Judge Spatt's decison, dated October 5, 1993, resolves motions filed by Motorola, Hazeltine Corporation, and Emerson. After reviewing this filing, we have concluded that it provides no grounds to change our determination in the instant AM stereo proceeding.

[21] *See Ex Parte* presentation of Motorola, Inc., August 12, 1993.

[22] On October 14, 1993, Motorola filed a pleading entitled "Response of Motorola, Inc." responding to filings by Leonard Kahn and David Solinske with regard to tape recorded comparisons of the Kahn and C-Quam systems as received on a Motorola-type decoder. On October 20, 1993, Kahn responded to this pleading and filed a "Response to Motorola's October 14, 1993, Supplemental Filing." Because these pleadings were filed late in this proceeding, we did not have the opportunity to evaluate the arguments presented therein.

[23] *See Report and Order,* MM Docket No. 87-267, 6 FCC Rcd. 6273, 6338-39 (1991). *See also Memorandum Opinion and Order,* MM Docket No. 87-267, 8 FCC Rcd. 3250, 3256-57 (1993).

[24] AMAX-certified receivers must comply with specified bandwidth and distortion standards to ensure high-fidelity reception capability, have adjustable bandwidth settings, and be capable of tuning the expanded portion of the AM band from 1610 to 1700 kHz.

argues that the Commission should mandate full compliance with the C-Quam standard and believes the one year transition period proposed is adequate to allow broadcasters time to finance purchase of new equipment. It maintains that, even with modifications, the Harris AM stereo signal is not fully compatible with C-Quam receivers and results in higher audio distortion when received on C-Quam radios. Motorola and Harris, on the other hand, state that full conversion of Harris equipment to the C-Quam standard is both feasible and desirable. Motorola suggests a more flexible transition period of at least one year but not more than two years. Hershberger maintains that field experience has demonstrated that the Harris system is adequately compatible with the Motorola system, and that broadcasters using the Harris system should be allowed to continue to do so because it would encourage the development of synchronous detection AM receivers.

20. Because of the relatively small number of Harris systems in operation, we do not agree that allowing them to continue to operate without conversion to C-Quam will significantly encourage development of synchronous detection receivers or have any other positive impact on the AM broadcast service. We agree with BE, Harris, and Motorola that the public interest will be best served by mandating full compliance with the C-Quam standard. We note the clear Congressional mandate to adopt a single AM stereo transmitting standard and therefore feel that it is important that all broadcasters comply with that standard. We further note the lack of any specific opposition from broadcasters employing alternative systems to our proposed transition schedule. Accordingly, we are requiring stations that employ alternative systems for stereo operation to discontinue such operation as of one year from the effective date of these rules.

21. *Kahn "POWER-side" Operation.* Several parties express concern over the continued acceptability under our rules of operating using the Kahn POWER-side AM single-sideband system. POWER-side operation, as distinct from Kahn stereo operation, involves modulating an AM transmitter with two independent sidebands, containing identical program material, but with intentional level and frequency response differences. This system is implemented with a Kahn independent sideband stereo exciter and is claimed to have certain advantages for reception with monophonic receivers, particularly in adjacent-channel interference situations. CTI and Furr argue that adoption of the proposed standard would prohibit such an implementation. Motorola maintains that the Kahn POWER-side mode of operation is not stereophonic and questions its legality under the present rules.

22. Our AM rules do not include a definition of the term "stereophonic." However, generally accepted definitions of stereo service infer two or more channels of audio information designed to produce an audio "image" when demodulated by an appropriate receiver. On this basis, we find that stations employing the Kahn POWER-side system are not subject to the provisions of the stereophonic transmitting standard adopted herein and may continue to be operated, provided that the program material fed to both channels of the exciter is identical in content.

23. *Compatibility with Subcarrier Systems and Future Digital Audio Radio.* Black River Broadcasting and Paloma raise concerns about the extent to which the Motorola C-Quam system is compatible with future ancillary subcarrier systems such as utility load management and metering systems and paging systems. CTI maintains that the Motorola system is not likely to be compatible with future in-band, on-channel digital audio radio systems. We agree with Motorola that there is no reason to believe that the C-Quam system, the Kahn system, or any other existing system would have any advantage in compatibility with future ancillary subcarrier systems or future digital transmission systems for the AM radio service. Moreover, as we have no specific information on the likely design of such systems, we could not presuppose to consider fairly issues relating to their compatibility with AM stereo technologies.

24. *Excessive Bandwidth Allegations.* Hershberger alleges that the Motorola C-Quam system violates the bandwidth criteria specified in Section 73.44 of the Commission's Rules under program conditions. His allegations are based on his own interpretations of proper bandwidth measurement techniques which differ from the measurement procedures specified in Sections 73.44(a) and 73.128(b)(1) of the rules[25] and the Commission's own interpretations of these procedures which have historically been consistently applied since the inception of AM stereophonic service. We find no evidence that currently authorized C-Quam equipment violates the Commission's bandwidth requirements when properly operated. Further, we note that all AM stations must comply with the emission limitations which were developed by the National Radio Systems Committee specified in Section 73.44 of our rules.

25. *Signal Monitoring and Tolerance Issues.* In its comments, Delta suggests three modifications to the proposed AM stereo rules: 1) that proposed rule section 73.128(c)(5) be clarified to state that the maximum phase excursion is a limit that is not to be exceeded and that, therefore, the necessary measuring equipment must always be present and operating, 2) that the pilot injection level should be specified as nominally 5% with a tolerance of +1%, -1%, and 3) that the maximum total harmonic distortion specification of 1% for the pilot tone, being unduly restrictive, be increased to 3%.

26. With regard to Delta's first proposal, we do not agree that there is a need to clarify the proposed rule language. The phase excursion parameter is identified as a maximum value not to be exceeded, and 73.128(a) clearly requires installation of necessary monitoring equipment to determine that the transmissions conform to the modulation characteristics specified. Accordingly, we are not adopting this suggested change. We do, however, agree that it is impractical to specify the pilot injection level without any tolerance specification. We also agree that, in the absence of complaints about audibility of harmonics from existing equipment with higher distortion levels, the 1% specified maximum harmonic distortion is too restrictive. Motorola, from whose own internal standard these specifications were adapted, has not raised any objection to these proposed changes in its reply comments. We will therefore specify the pilot injection level at 5% with a tolerance of +1%, -1%, and the maximum total harmonic distortion of the pilot tone at 3%.

27. *Pilot Tone Protection.* Motorola suggests that we establish a region of the spectrum within 5 Hz on either side of the 25 Hz C-Quam pilot tone that is protected in a

[25] See 47 C.F.R. Sections 73.44(a) and 73.128(b)(1).

similar manner to the protection afforded stereo pilot tones in the FM broadcast service. Motorola does not provide any justification for this proposal in its submissions.

28. We have previously considered whether there was any need to protect AM stereo pilots in order to ensure signal quality, and concluded that broadcasters have a strong incentive to protect their own transmissions.[26] Because improper pilot frequency use can impair only the quality of the station involved, stations have a strong self-interest in making appropriate use of AM stereo pilots. Absent any information to the contrary, we do not find it necessary to reexamine our decision to decline to protect the pilot tones of AM stereo systems.

29. *Patent Licensing Policies.* As proposed in the *Notice*, we are conditioning the selection of Motorola's system as the AM stereo standard by requiring Motorola to license its patents to other parties under fair and reasonable terms.[27]

PROCEDURAL MATTERS

30. *Regulatory Flexibility Analysis.* The Final Regulatory Flexibility Analysis pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. Section 608, is contained in Appendix A.

ORDERING CLAUSES

31. Accordingly, IT IS ORDERED, that Part 73 of the Commission's Rules and Regulations IS AMENDED as specified in Appendix B, effective 90 days after publication in the Federal Register. IT IS FURTHER ORDERED, that this proceeding IS TERMINATED. This action is taken pursuant to Sections 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).

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

APPENDIX A

FINAL REGULATORY ANALYSIS

Pursuant to the Regulatory Flexibility Act of 1980, the Commission's final analysis is as follows:

I. Need and purpose of this action:

This action is taken to select an AM stereophonic transmitting equipment standard, as required under Section 214 of the Telecommunications Authorization Act of 1992.

II. Summary of the issues raised by the public comments in response to the Initial Regulatory Flexibility Analysis:

There were no comments submitted in response to the Initial Regulatory Flexibility Analysis.

III. Significant alternatives considered:

The *Notice of Proposed Rulemaking* in this proceeding proposed to adopt the Motorola C-Quam system as the AM stereophonic transmitting standard. This proposal was supported by the industry associations for the broadcast and receiver industries, most broadcast equipment manufacturers who commented, and others. Comments were received from the proponent of the other currently viable AM stereo system and supporters of that system, primarily from the broadcast engineering community, either supporting the alternative system or suggesting further testing to determine technical superiority and use of such superiority as the primary criterion for system selection. We determined that: marketplace convergence on a single system should remain the primary basis for the decision, as proposed, that all the technically viable systems had been adequately tested previously, that the Motorola system provides high quality service to the public, and that there is no indication that the available alternative systems are significantly superior, if at all.

[26] *See Memorandum Opinion and Order*, 3 FCC Rcd No. 2, 403, 405 (1988). *See also Report and Order* in MM Docket No. 83-1322, adopted June 27, 1984, 100 FCC 2d, 49 FR 34011.

[27] *See* FCC Public Notice, Revised Patent Procedures of the Federal Communications Commission, Public Notice 13948, December 6, 1961.

APPENDIX B

FINAL RULES

I. Part 73 of Title 47 of the Code of Federal Regulations is 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. Stations transmitting stereophonic programs prior to *(insert date 90 days after publication in Federal Register)* may continue to do so until *(insert date one year plus 90 days after publication in Federal Register)* as long as they continue to comply with the rules in effect prior to *(insert date 90 days after publication in Federal Register)*. Stations using the Harris AM stereo system may continue to do so indefinitely as long as they continue to comply with the rules in effect prior to *(insert date 90 days after publication in Federal Register)*.

(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, NRSC-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
$m_{peak}(L(t) + R(t)) = 1$ for 100% amplitude modulation,
$m_{peak}(L(t) - R(t)) = 1$ 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 3% 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, -1%.

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

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

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
ϖ_{sn} = the nth order angular velocity of the sum signal
ϖ_{dn} = the nth order angular velocity of the difference signal
ϖ_c = the angular velocity of the carrier

ϕ_{sn} = the angle of the nth order term = $\tan^{-1}\left[\frac{B_{sn}}{A_{sn}}\right]$

ϕ_{dn} = the angle of the nth 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}

APPENDIX C

List of Commenting Parties

Comments

Broadcast Electronics, Inc.
Capital Cities/ABC, Inc.
Cohen, Dippell, and Everist, P. C.
Communications Technologies, Inc.
Delta Electronics, Inc.
James Dorrence
Electronic Industries Association/Consumer Electronics Group
John R. Furr
Philip E. Galasso
Harris Corporation - Harris Allied Broadcast Division
Christopher Hayes
David L. Hershberger
Leonard R. Kahn
Peter Kraushar
Motorola, Inc.
National Association of Broadcasters
Paloma Blanca Radio, Ltd.
Lee Sutherland Parr
David H. Solinske

Reply Comments

Black River Broadcasting
Broadcast Electronics, Inc.
Capital Cities/ABC, Inc.
Jules Cohen and Associates
Cohen, Dippell, and Everist, P. C.
Electronic Industries Association/Consumer Electronics Group
Leonard R. Kahn
John E. Morris
Motorola, Inc.
Harold Munn, Jr.
Warren G. Smith
Titus Technological Laboratories
Rich Wood

Additional or Supplemental Comments

Leonard R. Kahn
Steven L. Karty
Philip J. Lerza
Motorola, Inc.
David H. Solinske