

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

MM Docket No. 88-376

In the matter of

Amendment of the Commission's Rules RM-5532
to improve the quality of the AM RM-6174
Broadcast Service by reducing
adjacent channel interference and by
eliminating restrictions pertaining
to the protected daytime contour.

FIRST REPORT AND ORDER

Adopted: April 12, 1989; Released: April 27, 1989

By the Commission: Commissioner Dennis issuing a separate statement.

INTRODUCTION

1. The *Notice of Proposed Rule Making*¹ (*Notice*) in the above captioned matter proposed two changes in the technical rules governing the standard broadcast (AM) service. This Order addresses one of these proposals: the matter of adjacent channel emission limits. The other proposal, the elimination of the "first service" provision in Section 73.37(b), will be treated in a subsequent Second Report and Order. After carefully considering the comments and reply comments filed in response to the *Notice*,² the Commission herein adopts the National Radio Systems Committee (NRSC) emission limitation (commonly known as "NRSC-2") as a new AM broadcast station standard. However, until June 30, 1994, stations employing the NRSC audio pre-emphasis standard (commonly known as "NRSC-1") will be presumed to comply with NRSC-2 in the absence of specific information to the contrary.

BACKGROUND

2. The *Notice* discussed AM adjacent channel interference, AM audio processing practices and their effects on the quality of the AM broadcast service.³ It presented two new standards developed by the National Radio Systems Committee, a cooperative effort of the NAB and EIA. These standards are intended to reduce the current occupied RF bandwidth of AM broadcast transmitters from 30 kHz to a nominal 20 kHz to achieve a reduction in interference levels and to improve the reception quality of the AM service.

3. One of the standards, known as NRSC-1, is an audio processing standard that specifies a particular pre-emphasis⁴ characteristic (i.e., an increase in amplitude relative to the reference frequency⁵) for audio frequencies between 3.0 kHz and 9.5 kHz. However, it requires great attenuation of audio frequencies above 10 kHz in order to reduce adjacent channel interference. Because of inherent

shortcomings associated with use of NRSC-1 alone, we specifically declined proposing to mandate its use in the *Notice*.

4. The other standard, known as NRSC-2, defines a new emission limitation for AM stations. Because we believe NRSC-2 to be the more comprehensive of the two standards in terms of ensuring a reduction in adjacent channel interference, it was the principal focus of the *Notice* and was specifically proposed for adoption. However, we did seek comment on a "presumptive compliance" alternative in which licensees using NRSC-1 pre-emphasis would be presumed to comply with the NRSC-2 emission limitation, absent any evidence to the contrary.⁶ The comments and reply comments to the *Notice* further support our preliminary findings and convince us that our initial approach, adoption of the NRSC-2 emission limitation, remains the more effective course of action.

5. To provide a foundation for the analysis to follow, consider a typical AM transmission system. Program material originates at a microphone, turntable or other appropriate source. It is then fed through a mixing console (so that the loudness of each audio source can be adjusted and so that any special effects can be added), various audio processing equipment (used to adjust the average loudness and often, the average frequency response), some type of studio-transmitter link (a simple cable, if the transmitter is nearby, or a dedicated wireline or radio circuit), additional audio processing equipment (used to compensate for any degradation occurring in the studio-transmitter link) and finally, the transmitter modulator. Equipment having the NRSC-1 audio response characteristic could be included anywhere in this audio "chain," although it would preferably be located near the end, where its intended benefits could not be circumvented by compensatory adjustments made to subsequent audio processing equipment.

6. To reduce the potential for overmodulation, transmitters may include built-in or outboard protective circuits called limiters or clippers, many of which are adjustable to limit transmitter modulation to a specific level. However, in this limiting process, some audio distortion is generated, creating harmonically-related audio signal components that can be outside of the desired audio passband. If these undesired audio signal components are not adequately attenuated by post-clipper or post-limiter filtering circuits, they will produce unwanted spurious RF sidebands (known as "splatter") that may exceed the permissible emission limits.⁷ Splatter could also be produced by nonlinearities in transmitter or antenna circuits.⁸ Old tubes that have become defective and improper neutralization are other causes of splatter.

7. The preceding technical considerations must be kept in mind when evaluating the relative merits of the NRSC-1 and NRSC-2 technical standards. The fundamental premise of the *Notice* was that application of the emission limitation standard (NRSC-2), being a measure of the entire transmission system output, was a much more comprehensive method of limiting interference than application of an audio standard (NRSC-1), the effectiveness of which could be reduced by the operation of other circuits.

SUMMARY OF THE COMMENTS

Comments generally favoring adoption of NRSC-1

8. In general, commenters support both the NRSC-1 and the NRSC-2 standards. However, most want the Commission to implement the NRSC-1 audio standard now but delay implementation of the NRSC-2 emission standard until January 1, 1992. AFCCE supports this NRSC-2 implementation date, saying that "compliance with (NRSC-2) may not be possible for all AM broadcast transmitters in operation. AM licensees having such transmitters have no alternative other than to retire the transmitters from service, regardless of the age or condition of the equipment."⁹

9. There is also concern about compliance costs associated with NRSC-2 versus NRSC-1. SBE notes that implementation of NRSC-1 typically would cost licensees between \$400 and \$700. However, it indicates that the current emission limitations "are so lenient that there is now little need for stations to carefully measure their occupied bandwidth. In contrast, if the NRSC-2 standard is adopted, a station would be prudent to employ an RF spectrum analyzer, a "splatter" monitor, or a similar device capable of quantitatively measuring the occupied bandwidth rather than relying on less precise methods (e.g., a careful listening test for excessive sideband energy using a high-quality receiver)."¹⁰ SBE further indicates that while most licensees already have the conventional audio equipment necessary to verify compliance with NRSC-1, they do not have equipment to verify compliance with NRSC-2. NAB notes that audio filters necessary to ensure compliance with NRSC-1 are more economical than the RF filters that may be required to comply with NRSC-2.¹¹

10. The commenters mention additional reasons for adopting NRSC-1. To date, only about 20% of AM licensees have implemented NRSC-1 as a voluntary audio standard. This may be due to the fact that NRSC-1 audio pre-emphasis will generally limit emitted bandwidth by reducing the treble or brightness of a station's sound. Because there is some perception that this is undesirable (unless everyone else does it), SBE notes that many licensees don't want to be the first in their market to make such a change.¹² Mandating the use of NRSC-1 is seen as a way of resolving this dilemma. SBE notes that "Mandatory adoption (of NRSC-1) by January 1, 1990, would send an unmistakable message to receiver manufacturers. Implementation of the receiver portion of the NRSC-1 standard, a complementary de-emphasis curve for receivers, would no longer be a gamble for receiver manufacturers."¹³

Comments generally favoring adoption of NRSC-2

11. However, other commenters support the preliminary findings set forth in the *Notice* and agree that our initial approach, adoption of the NRSC-2 emission limitation standard, would be the most effective way to alleviate adjacent channel interference. They agree with the *Notice* that NRSC-1 could easily (even if inadvertently) be circumvented. These commenters also dismiss some of the above concerns as being largely unfounded.

12. For example, on the matter of transmitters' ability to comply with NRSC-2, Orban notes that "In developing NRSC-2, the (NRSC) wished to create a standard that could be met by any acceptable broadcast transmitter in

perfect working order, fed by NRSC-1 processed audio."¹⁴ Group W, which favors immediate adoption of both the NRSC-1 and NRSC-2 standards, indicates that "After adopting the NRSC-1 audio standard, the NRSC proceeded to evaluate the effectiveness of that audio standard after it passed through the transmitter. Analysis of broadcasting stations employing NRSC-1 led to a standard for the occupied bandwidth of the station at the output of the transmitter. Changes were made in the standard to accommodate various modulation schemes and older transmitters."¹⁵

13. Delta rebuts allegations that some transmitters may become obsolete by stating, "A broadcaster operating an AM station in reasonable repair should not fear the proposed RF mask."¹⁶ There should be no need for a new transmitter."¹⁷ Delta further supports that statement, based upon experience with a variety of broadcast transmitters, by stating: Delta has installed over 180 C-QUAM AM stereo systems to date. Over half of these were installed on transmitters which were at least 5 years old and several were over 20 years old. All of these AM stereo systems have been successfully installed and adjusted without ever requiring transmitter replacement. Generally, only minor tuning and transmitter neutralization was required with occasional replacement of aged modulator tubes. This extensive experience demonstrates that even older transmitters will easily meet the stringent parameters for AM stereo transmission when properly maintained and aligned. Reducing IPM and envelope modulation distortion are the same improvements that will enable a transmitter to meet the RF mask limitations.¹⁸

14. Group W concurs, stating that, "a transmitter that is in proper technical adjustment and employing an NRSC-1 audio processor will meet the requirements of the RF Mask of NRSC-2. Many things can go wrong in a transmitter after the NRSC-1 processor that can cause emissions outside of the desired bandwidth. However, it is unlikely that these undesired emissions would be the result of transmitter design, but rather they would be due to malfunction or improper adjustment."¹⁹ NAB adds that it "has provided evidence that even when some transmitter clipping is employed, NRSC-2 will be satisfied by virtually all stations implementing NRSC-1."²⁰

15. Other commenters question whether rigid adherence to NRSC-1 is possible, whether it will be effective in reducing adjacent channel interference, and whether it is even desirable in view of the audio processing limitations it could impose on licensees.

16. Orban, a manufacturer of broadcast audio processing equipment, notes that multi-band audio processors vary their frequency response according to the spectral content of the input audio, and that consequently the instantaneous frequency response of such devices at any given time may depart significantly from the NRSC-1 standard, even if the average response is very close to the standard. Orban believes that it would be very difficult to incorporate a specification for this kind of complex, time-varying behavior in an FCC rule, and that enforcement of such a rule would be virtually impossible.²¹ Orban further notes that many stations have audio processors that cost more than five thousand dollars, and that requiring licensees to modify these processors to produce a dynamically controlled output spectrum according to some new audio standard would create significant financial hardship.²²

17. CRL notes that to be fully effective, the NRSC-1 modification must be installed as the last stage in the audio equipment group just prior to the modulator, with the audio characteristics specified only at that point in the system. However, Delta's comments indicate that even this does not guarantee that adjacent channel interference will be reduced. The potential inadequacy of NRSC-1 was documented by Delta in field measurements of actual stations.²³ One station reportedly had NRSC-1 audio filtering installed and operating, but also employed heavy transmitter clipping. Delta's spectrum analyzer photograph of that station shows numerous emissions at frequencies greater than 10 kHz removed from the carrier, where one would normally expect to see the "brick-wall filter" effect that is intended for signals emitted with NRSC-1 equipment.²⁴ Thus, Delta observes, "installing an audio filter and then operating a transmitter in such a manner that the spectrum above the filter cutoff frequency is filled back in does not achieve the objectives of the NRSC (to reduce interference)."²⁵ However, Delta believes that the station mentioned above should be capable of meeting the NRSC-2 emission limitations with inexpensive repairs and/or adjustments.²⁶

18. On the other hand, Delta found a station not equipped with NRSC-1 pre-emphasis that met the NRSC-2 emission limitation. This was attributed to the use of conservative audio processing techniques and care to avoid overmodulation. Delta concludes that installation of the NRSC audio filter is no guarantee that the RF emissions will be maintained within the NRSC-2 specification or even the (current) FCC specifications.²⁷

19. Greater Media argues that AM station licensees should be allowed to determine the amount of pre-emphasis to use at their stations, noting that some stations may use audio pre-emphasis to compensate for narrow antenna system frequency response.²⁸ Other commenters pointed out natural incentives to use NRSC-1 audio processing. Orban states that it has demonstrated that using NRSC-1 transmitter pre-emphasis and complementary receiver de-emphasis provides a flat power spectrum response, while use of more extreme pre-emphasis and de-emphasis combinations cause the system to lose power at high frequencies.²⁹ CRL supports this observation, indicating that in a survey of stations using audio processing equipment, the "average sound" characteristics of most stations responding was very close to the NRSC-1 pre-emphasis curve.³⁰ Orban further states that AM licensees have additional incentive to limit pre-emphasis to the NRSC-1 standard because use of greater pre-emphasis will cause many receivers that contain slightly asymmetrical ceramic IF filters (due to loose manufacturing tolerances) to produce objectionably distorted audio.³¹

20. In the only comment raising a potential measurement problem associated with the NRSC-2 emission limitation, Bonneville observed that it is possible for transient bursts of audio to cause spurious sidebands beyond 10 kHz that may not be detected with a spectrum analyzer (or other appropriate measurement device) resolution bandwidth of only 300 Hz used to measure compliance.³²

Comments concerning the presumptive compliance alternative

21. The *Notice* tentatively concluded that the costs of complying with NRSC-1 or NRSC-2 should be about the same. Nevertheless, it solicited comment on whether there might be a public interest benefit associated with presum-

ing that stations complying with NRSC-1 meet NRSC-2, absent evidence to the contrary. This alternative received some support, particularly from those who favor adoption of NRSC-1 but view adoption of NRSC-2 as being more or less inevitable. Thus, SBE proposes that any station implementing NRSC-1 by January 1, 1990, be deemed to be in compliance with NRSC-2.³³ However, SBE asks that such stations be exempt from the current requirement in Section 73.44(a)(1) of the Commission's Rules that licensees measure occupied bandwidth on a routine, annual basis unless notified by the FCC that there is reason to believe excessive bandwidth exists. In that eventuality, they recommend that the station be given 30 days to make measurements and initiate corrective action before the Commission would take enforcement action or issue a Notice of Apparent Liability. As an exception to this policy, SBE suggests that the Engineer-in-Charge of the FCC radio district in which the station resides be delegated authority to specify a shorter remedial period if there is evidence of harmful interference.

22. NAB also supports the presumptive compliance proposal, indicating that it would provide a realistic bridge between compliance with NRSC-1 and NRSC-2. It notes that the Advisory Committee on Radio Broadcasting supported a presumptive compliance method that would require stations to have NRSC-1 equipment in place and operating by January 1, 1990, and two years later require compliance with NRSC-2. However, NAB disagrees with fixing any particular date for NRSC-2 compliance in view of uncertainty over future availability of various (NRSC-2) measuring devices.³⁴ Thus, NAB suggests that the Commission reconsider mandating NRSC-2 approximately two years after NRSC-1 is implemented.³⁵

23. Greater Media and others also expressed support for the presumptive compliance proposal. However, several commenters expressed a note of caution. Orban warned that, "It is dangerous to assume that NRSC-2 will automatically be satisfied if an NRSC-1 filter is installed, because overmodulation or transmitter malfunction can still cause excessive occupied bandwidth."³⁶ Group W agreed that although it is unlikely that undesired emissions would result from transmitter design, transmitter malfunction or improper adjustment could cause NRSC-2 to be exceeded.³⁷ The previously mentioned comments of Delta (*see* Paragraph 17, *supra*) further support this view.

DISCUSSION

24. The Commission continues to believe that adoption of the NRSC-2 emission limitation is the best way of ensuring a reduction of adjacent channel interference in the AM service. There are six fundamental reasons for this conclusion: 1) by itself, the NRSC-1 audio standard will not be effective in alleviating interference produced by overmodulation or transmission system anomalies; it requires the NRSC-2 emission limitation to be fully effective; 2) the characteristics of the audio response intended to be produced by the NRSC-1 filter can be readily circumvented or abused by adjustments made to other audio processing equipment; moreover, to the extent NRSC-1 specifies a particular pre-emphasis of audio signals below 10 kHz, it limits licensees' flexibility in adjusting their audio processing equipment; 3) the NRSC-2 emission limitation alone provides effective control of interference due to emitted signals; thus, it renders NRSC-1 redundant; 4) very few transmitters will be unable to comply with

NRSC-2; 5) the NRSC-2 emission limitation is readily enforceable through over-the-air monitoring techniques, whereas determining compliance with NRSC-1 would require an on-site inspection; 6) the cost to licensees of ensuring that a station conforms to NRSC-1 is the same as ensuring that it complies with NRSC-2 (determining the efficacy of either method would require the use of spectrum analysis procedures). These points are developed below.

Efficacy of NRSC-2 versus NRSC-1

25. Implementation of the NRSC-1 audio standard alone would probably lead to some reduction in adjacent channel interference in the AM service. However, because it does not address important transmission system problems such as transmitter overmodulation, incidental phase modulation and spurious signal output, its effectiveness in limiting interference is open to question. We specifically expressed our concern about this problem in the *Notice* and pointed out that the record at that time was deficient with respect to the additional rules that would be required to limit distortion and splatter produced in the transmitter.³⁸ The record remains silent on this important matter.

26. The comments support our opinion that the NRSC-1 audio standard does not address the transmitter performance requirements that are necessary to ensure a reduction in splatter and adjacent channel interference levels. Under the NRSC-1 approach, interference generated in the transmitter that is not in excess of the current, wider bandwidth emission limits would not be subject to regulation and would continue to degrade the AM service. Therefore, we must conclude that mandating the use of the NRSC-1 audio standard would not provide sufficient regulatory control to limit splatter interference to any greater extent than our current rules. The results of Delta's survey confirm this view. Adherence to good engineering practice is more important than mere use of NRSC-1 audio processing alone in terms of reducing adjacent channel interference. The NRSC-2 emission limitation, being a comprehensive measure of compliance with good engineering practice, appears to be a necessary addition to any formal adoption of the NRSC-1 audio standard. Accordingly, we decline to adopt the NRSC-1 audio standard as a mandatory requirement. This decision renders moot the suggestion of NAB and Group W to institute a special equipment authorization program for NRSC-1 equipment.

Regulatory flexibility

27. We believe that the NRSC-1 audio standard, which specifies in detail a transmitter input frequency response characteristic, should be considered as a highly recommended but nevertheless voluntary standard in order that licensees may be afforded as much flexibility as possible in terms of determining appropriate transmission system input parameters. By focusing our attention on transmission system output standards, such as NRSC-2, we fulfill our regulatory mandate of limiting the interference in the various radio services while allowing licensees to exercise maximum technical creativity in the provision of service.

Comparison of NRSC-1 and NRSC-2

28. The comments suggest that there may be some ambiguity in the way licensees perceive the NRSC-1 audio standard. Some licensees seem to equate NRSC-1 with

some kind of "magic box" that for a modest cost can be installed in the audio line and will solve all interference problems. We continue to be concerned that those adhering to this viewpoint may be unaware that improper operation of other elements in the audio chain could negate much of the benefit intended through the use of NRSC-1.

29. However, we believe most commenters more correctly view NRSC-1 as a particular audio processing characteristic that may reduce adjacent channel interference. However, we continue to be concerned that even these commenters may consider NRSC-1 only as an approximate or "target" response, because to consider it as an absolute response would unduly limit their ability to make reasonable, but NRSC-1 incompatible, audio processing equipment adjustments. Rigid adherence to NRSC-1 could negate much of the flexibility currently afforded by their equipment. We agree with Orban that the NRSC-1 response characteristic must be integrated into the audio processing equipment as the approximate response if it is to be effective. However, the record is unclear on how many broadcasters share this view and how many would be willing to forfeit the considerable audio processing flexibility afforded by their current equipment if rigid compliance with NRSC-1 is required. To set no limits on audio processing could potentially negate the benefits of NRSC-1. Yet to mandate its use would restrict licensees' freedom to process their audio in ways that are compatible with a reduction in adjacent channel interference that would be provided by the NRSC-2 emission limitation. Thus, we conclude that use of NRSC-1 should be implemented only on a recommended but voluntary basis.

30. Almost all of the commenters favor our eventual adoption of NRSC-2 as the new AM station emission limitation. NRSC-2 requires that emissions removed more than a 10 kHz from the carrier be substantially attenuated in order to reduce adjacent channel interference.³⁹ Unlike the NRSC-1 audio standard, the NRSC-2 emission limitation regulates the technical characteristics of the transmitted signal, including interference-causing emissions generated in the transmitter by overmodulation or other causes. Such carefully chosen emission limitations are better able to control interference than an audio-based standard.

31. An important issue is whether NRSC-2 should be implemented now, or some time in the future. In this connection we take note of Orban's comment that the current definition of the NRSC-2 emission limitation is intended as an interim standard, and that to accommodate most transmitters, it is not as stringent as it might be. We concur with this assessment; however, the NRSC-2 emission limitation requires considerable attenuation of sidebands removed 10 kHz or more from the carrier frequency and thus should be quite effective in reducing levels of adjacent channel interference. Its adoption also send a clear signal to receiver manufacturers that AM technical quality is improving.

Implementation and compliance costs

32. Some of the commenters express concern that if we adopt NRSC-2 now, implementation and compliance costs may be greater than if we were to adopt NRSC-1. SBE argues that the current emission limitations are so loose that licensees need not perform measurements to verify compliance with them, and that compliance with more realistic standards could entail some expense. This situ-

ation is not envisioned by the current rules. Section 73.1590 of the Commission's Rules requires AM station licensees to perform measurements to verify compliance with the current emission limitations at least once every 14 months.⁴⁰ Thus, amendment of the emission limitations does not impose any new regulatory requirement.

33. We are concerned that some commenters who believe that unnecessary additional effort, time or expense would be required to comply with NRSC-2 may fail to recognize that simply installing an NRSC-1 filter may not be sufficient to achieve a real reduction in the levels of adjacent channel interference. After conversion to NRSC-1, it is highly desirable that the station equipment be carefully analyzed, adjusted, and operated in a manner that will produce all the benefits intended by the addition of the NRSC-1 equipment. We believe that in practice, any additional time, effort or expense incurred to verify proper station operation will be the same for either NRSC-1 or NRSC-2.

34. Nevertheless, under the rules we are adopting, licensees will continue to enjoy considerable latitude in terms of the frequency and the method used to determine station compliance with the new regulations. There is no requirement for continuous monitoring of emissions. Therefore, a licensee is free to defer verifying compliance with NRSC-2 until the time scheduled for determining compliance with the former emission limitations.

35. There is also no requirement that a licensee own measurement equipment. Measurement equipment may be rented, borrowed or shared.⁴¹ We recognize that in many cases, such equipment will be owned by the consulting engineer(s) retained by licensees. Thus, the need to determine compliance with NRSC-2 does not appear to impose significant additional cost, nor does it warrant delay in implementation as some commenters suggest.

36. Some commenters express concern that not all transmitters, after having been properly maintained and adjusted, may be able to meet the the NRSC-2 requirements, and that this could require purchase of a new transmitter at considerable cost. The record contains no evidence that any particular type of AM transmitter will be unable to meet the NRSC-2 emission limitation. The comments of Orban, Delta and Group W indicate that NRSC-2 was designed with current broadcast transmitters in mind and that cases requiring transmitter replacement should be few, if any. These can be dealt with by the FCC individually. Any transmitter that is properly adjusted and maintaining the minimum distortion to accommodate stereo operation should easily meet the emission limitation. Thus, we consider it unlikely that transmitter replacement will be necessary or that any increased burden will be the result from our requiring licensees to comply with the NRSC-2 emission limitations.

Presumptive compliance

37. The *Notice* also discussed an alternate regulatory approach whereby, in the absence of evidence to the contrary, stations adhering to the NRSC-1 audio standard would be presumed to comply with the NRSC-2 emission limitations. This concept is based upon the assumption that stations employing NRSC-1 audio processing and operating a properly adjusted and maintained transmitter should meet the NRSC-2 emission limitations. Because reduced second adjacent channel interference has been

noticed from many stations that have voluntarily installed NRSC-1 audio processors, such an assumption appears warranted.

38. As discussed above, it appears that there will be little, if any, difference in compliance cost between NRSC-1 and NRSC-2. Nevertheless, many of the commenters favor the presumptive compliance alternative suggested in the *Notice* as a means of ensuring that implementation and compliance costs are minimized. Thus, we are adopting a presumptive compliance approach with respect to implementation of NRSC-2, as described below.

39. Beginning June 30, 1990, all AM stations will be required to comply with the NRSC-2 emission limitations. However, until June 30, 1994, broadcast licensees also may elect to ascertain compliance with the NRSC-2 standard by adhering to the NRSC-1 audio bandpass and pre-emphasis standard.⁴² Licensees making this election will be presumed to comply with the new emission limits, and they will not be required to make periodic emission measurements as required by Section 73.1590(a)(6). The presumption of compliance with the emission limits may be rebutted by technical evidence (e.g., spectrum analyzer measurement results) of non-compliance. If we receive interference complaints containing this evidence, we will require licensees to make their own measurements and take corrective action, if appropriate.⁴³

40. Licensees of existing stations who wish to operate pursuant to this presumptive compliance alternative must comply with the NRSC-1 standard by June 30, 1990. Licensees of new AM stations who wish to operate pursuant to this alternative must comply with the NRSC-1 standard upon commencement of operation.

NRSC-2 measurement

41. We note Bonneville' concern that use of 300 Hz spectrum analyzer resolution may not detect transient bursts of splatter above 10 kHz. The 300 Hz resolution bandwidth is primarily necessary to accurately resolve the steep attenuation characteristic slope between 10 kHz and 10.5 kHz. For higher frequencies where emission rolloff is more gradual, a narrow bandwidth is less critical in ascertaining spectrum content. Consequently, a wider bandwidth could be employed in this region. To alleviate this concern, a wider resolution bandwidth may be employed to measure emitted frequencies offset beyond 11.5 kHz in cases where splatter interference from fast risetime emission bursts is suspected.

42. We have also noted a discrepancy between the audio attenuation required by NRSC-1 and the RF attenuation required by the early version of the NRSC-2 standard⁴⁴ contained in the *Notice* in the region 10 kHz-10.133 kHz. The early version of NRSC-2 required an attenuation of 25 dB at 10 kHz, whereas the current specification makes a minor adjustment in the region 10 kHz-10.133 kHz to account for the lesser audio attenuation required by NRSC-1. We believe that the most straightforward approach to eliminate this ambiguity between the two standards is simply to adjust the initial 25 dB RF attenuation step to begin at a 10.2 kHz offset rather than at 10 kHz as we initially proposed. This 200 Hz adjustment should not detract from the effectiveness of the NRSC-2 emission limitation and should facilitate measurements. Additionally, the early version of NRSC-2 required 80 dB attenuation for emissions beyond 75 kHz of carrier for all transmitters, rather than taking transmitter power into account as do our current rules and the current NRSC-2

emission limitation. Therefore, we have also revised the minimum attenuation required beyond 75 kHz to conform to the traditional practice. This is consistent with the current NRSC-2 specifications.

43. Based on the foregoing, we conclude that adoption of the NRSC-2 emission limitation will ensure that current levels of splatter and spurious emissions are reduced. Accordingly, we are adopting the NRSC-2 emission limitations as proposed, with the minor modifications discussed above.

OTHER MATTERS

44. The joint comment of "Several Stations" requests that the Commission modify Section 73.37(a), which currently prohibits overlap of the 0.5 mV/m contours of stations separated in frequency by 10 kHz, to permit overlap up to the 1.0 mV/m contours of such stations, provided that the stations are owned by the same group or enter into an agreement to accept interference from such overlap. However, this request is beyond the scope of this proceeding and has not been considered.

45. Station KXKW requests that it be permitted to operate at full power during presunrise and postsunset periods. This request is beyond the scope of this proceeding and has not been considered.

46. The firm of du Treil, Lundin & Rackley requests that the Commission amend Section 73.21(b)(1) to permit Class III regional stations located within the contiguous states to increase power to a maximum level of 50 kW. This request is also beyond the scope of the instant proceeding and not considered.

PAPERWORK REDUCTION ACT STATEMENT

47. The rule changes adopted herein have been analyzed with respect to the Paperwork Reduction Act of 1980 and found to contain no new or modified form, information collection, and/or record keeping, labeling, disclosure, or record retention requirements; and will not increase or decrease the burden hours on the public.

48. FINAL REGULATORY FLEXIBILITY ANALYSIS

I. Reason for Action: This action is intended to alleviate technical shortcomings characteristic of the AM broadcast service to make it more competitive with alternative audio delivery services (principally, the FM radio service).

II. Objectives: The objectives of this proceeding are to adopt a new emission limitation to reduce second and third adjacent channel interference to AM broadcast stations.

III. Legal Basis: The action taken by this *Order* is authorized by Sections 4(i) and (j), 302, 303 and 403 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i),(j),302,303,403.

IV. Description, Potential Impact and Number of Small Entities Affected: The action proposed in this proceeding would benefit nearly 5,000 AM broadcast station licensees by reducing second and third adjacent channel interference. The cost of modifying transmitters to comply with the new emission standard may be several hundred dollars per station.

V. Recording, Record Keeping and Other Compliance Requirements: None.

VI. Federal Rules which Overlap, Duplicate or Conflict with this Rule: None.

VII. Any Significant Alternative Minimizing Impact on Small Entities and Consistent with the Stated Objectives: None.

49. The Secretary shall send a copy of this *Report and Order*, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with paragraph 603(a) of the Regulatory Flexibility Act, 5 U.S.C. Section 603(a)(1982).

ORDERING CLAUSES

50. Accordingly, IT IS ORDERED THAT effective June 30, 1990, Part 73 of the Commission's Rules IS AMENDED as set forth in the Appendix below. This action is taken pursuant to authority contained in Sections 4 and 303 of the Communications Act of 1934, as amended, 47 U.S.C. §§154,303.

FEDERAL COMMUNICATIONS COMMISSION

Donna R. Searcy
Secretary

APPENDIX

Title 47 CFR Part 73 is amended, effective June 30, 1990, as follows:

1. The authority citation for 47 CFR Part 73 continues to read as follows:

Authority: 47 U.S.C. 154 and 303.

2. 47 CFR 73.44 is amended by revising paragraphs (a) and (b) and adding paragraph (e) to read as follows:

§73.44 Emission Limitations.

(a) The emissions of stations in the AM service shall be attenuated in accordance with the requirements specified in paragraph (b) of this Section. Emissions shall be measured using properly operated and suitable swept-frequency RF spectrum analyzer using a peak hold duration of 10 minutes, no video filtering, and a 300 Hz resolution bandwidth, except that a wider resolution bandwidth may be employed above 11.5 kHz to detect transient emissions. Alternatively, other specialized receivers or monitors with appropriate characteristics may be used to determine compliance with the provisions of this section, provided that any disputes over measurement accuracy are resolved in favor of measurements obtained by using a calibrated spectrum analyzer adjusted as set forth above.

(b) Emissions 10.2 kHz to 20 kHz removed from the carrier must be attenuated at least 25 dB below the unmodulated carrier level, emissions 20 kHz to 30 kHz removed from the carrier must be attenuated at least 35

dB below the unmodulated carrier level, emissions 30 kHz to 60 kHz removed from the carrier must be attenuated at least [5 + 1 dB/kHz] below the unmodulated carrier level, and emissions between 60 kHz and 75 kHz of the carrier frequency must be attenuated at least 65 dB below the unmodulated carrier level. Emissions removed by more than 75 kHz must be attenuated at least 43 + 10 Log (Power in watts) or 80 dB below the unmodulated carrier level, whichever is the lesser attenuation, except for transmitters having power less than 158 watts, where the attenuation must be at least 65 dB below carrier level.

* * * * *

(e) Licensees of stations complying with the ANSI/EIA-549-1988, NRSC-1 AM Preemphasis/Deemphasis and Broadcast Transmission Bandwidth Specifications (NRSC-1), prior to June 30, 1990 or from the original commencement of operation will, until June 30, 1994, be considered to comply with paragraphs (a) and (b) of this section, absent any reason for the Commission to believe otherwise. Such stations are waived from having to make the periodic measurements required in Section 73.1590(a)(6) until June 30, 1994. However, licensees must make measurements to determine compliance with paragraphs (a) and (b) above upon receipt of an Official Notice of Violation or a Notice of Apparent Liability alleging noncompliance with those provisions, or upon specific request by the Commission.

FOOTNOTES

¹ See Notice of Proposed Rule Making, MM Docket No. 88-376, 3 FCC Rcd. 5687 (1988), summarized at 53 Fed. Reg. 36870 (1988).

² Comments were submitted by: 4-K Radio, Inc. (4-K Radio); Association for Broadcast Engineering Standards, Inc (ABES); Association of Federal Communications Consulting Engineers. (AFCCE); Bonneville International Corporation (Bonneville); Capital Cities/ABC, Inc. (Cap Cities); Circuit Research Labs, Inc. (CRL); Consumer Electronics Group-Electronic Industries Association. (CEG/EIA); du Treil, Lundin & Rackley, Inc; Delta Electronics, Inc. (Delta); GSM Media Corporation, WRGM (GSM); Greater Media, Inc. (Greater Media); KANE-AM (KANE); KXKW-AM (KXKW); Kneller Broadcasting of Charlotte County, Inc. (Kneller); National Association of Broadcasters (NAB); National Public Radio (NPR); Orban Associates, Inc. (Orban); Radio Advisory Committee (RAC); Society of Broadcast Engineers, Inc. (SBE); Stephen R. Weber, Jr. (Weber); WOKT, WTGR, WFTK, and WNOW (Several stations); Westinghouse Broadcasting Co (Group W). Reply comments were submitted by: CBS Inc. (CBS); Capital Cities/ABC, Inc. (Cap Cities); Delta Electronics, Inc. (Delta); GSM Media Corporation. (GSM); National Association of Broadcasters (NAB); Orban Associates Inc. (Orban) and the US Department of Commerce (NTIA).

³ See Notice, ¶¶ 7-11.

⁴ Pre-emphasis is a deliberate boosting of the high frequency content of an audio signal in order to overcome noise or, in the case of AM broadcasting, to compensate for receiver inadequacies.

⁵ The reference level employed for NRSC-1 audio measurements is 1 dB above a 200 Hz sinewave modulated at 90% negative modulation.

⁶ See Notice ¶ 24.

⁷ It is for this reason that equipment suppliers and consulting engineers caution that transmitter protective limiters should not be used to maintain average modulation or to increase loudness. See comments of Delta at 10, and *Modulation, Overmodulation and Occupied bandwidth; Recommendations for the AM Broadcast Industry*, Harrison J. Klein, P.E., in the *41st Annual NAB Engineering Conference Proceedings* (1987) (Klein Report), at 18.

⁸ Non-linear response on the part of any audio or radio frequency component of the transmission system can generate harmonic signal components that cause distortion.

⁹ See comments of AFCCE at 2. See also, comments of Greater Media at 3, GSM at ¶ 13, CRL at 6, RAC at 3, Bonneville at 4 and Cap Cities at 2.

¹⁰ See comments of SBE at 6.

¹¹ See comments of NAB at 5.

¹² See comments of SBE at 2.

¹³ *Ibid.*

¹⁴ See comments Orban at 4.

¹⁵ See comments of Group W at 3.

¹⁶ The term "RF mask" is commonly used by the commenters to refer to emission limitations (generally, the NRSC-2 emission limitations).

¹⁷ See comments of Delta at 26.

¹⁸ See reply comments of Delta at 3.

¹⁹ See comments of Group W at 5.

²⁰ See comments of NAB at 7. Although this comment was submitted in the context of justifying the adoption of NRSC-1 alone, it also is relevant to the issue of whether most transmitters can comply with NRSC-2.

²¹ See comments of Orban at 4.

²² See comments of Orban at 3.

²³ See comments of Delta at 14.

²⁴ See comments of Delta at 17, Figure 4.

²⁵ See comments of Delta at 14.

²⁶ See comments of Delta at 25.

²⁷ See comments of Delta at 18.

²⁸ See comments of Greater Media at 14.

²⁹ See comments of Orban at 3.

³⁰ See comments of CRL, at 1 & 2.

³¹ See comments of Orban at 3.

³² See comments of Bonneville at 5.

³³ See comments of SBE at 5.

³⁴ See comments of NAB at 10.

³⁵ NAB and Group W also recommend that the Commission institute a "type notification" program for NRSC-1 audio processing equipment to provide a way to enforce compliance with the audio standard.

³⁶ See comments of Orban at 5.

³⁷ See comments of Group W at 5.

³⁸ See Notice, ¶¶ 14-17.

³⁹ See *Emission Limitation for AM Broadcast Transmission*, EIA/IS-51, September, 1988 (NRSC-2) and Appendix A, §73.44(a) and (b).

⁴⁰ See 47 CFR 73.1590(a)(6) and (b).

⁴¹ See also comments of Orban at 5, "(Orban) believe(s) that such a splatter monitor could be shared by several stations in a market (perhaps as coordinated by the local chapter of the

Society of Broadcast Engineers). The splatter monitor would be used to periodically verify that a given station was adjusted to meet NRSC-2 requirements."

⁴² We see no reason why the presumptive compliance alternative should continue indefinitely. The termination date we have selected, June 30, 1994, is five years beyond the approximate release date of this *Order*, four years beyond the effective date of the new emission limitation and two years after the NRSC-2 implementation date envisioned by a number of the commenters. This is ample time for for broadcasters to verify that they do, in fact, comply with the new emission standard.

⁴³ SBE's request that licensees be given 30 days notice before the Commission initiates an enforcement action constitutes a fundamental and unprecedented change in the Commission's enforcement policy that is beyond the scope of the *Notice*. Therefore, it is denied.

⁴⁴ See, *Interim Emission Limitation for AM Broadcast Transmission*, National Radio Systems Committee, September 9, 1987.

**SEPARATE STATEMENT
OF
COMMISSIONER PATRICIA DIAZ DENNIS**

In Re: Amendment of Part 73 of the Commission's Rules to Adopt a new Emission Limitation.

Thomas Edison once said that the prerequisite for progress is discontent. Nobody is content with current levels of AM interference; as a result, there is a strong consensus for change. Today's decision is a significant step forward in our efforts to reduce AM interference. I hope that AM licensees will move quickly to comply with the new standard, and that receiver manufacturers will get the message and give consumers the option of buying higher-quality AM receivers. More broadly, this item is part of an overall review of our AM technical rules that could lead to major improvements in the technical quality of AM service. Individually, each of these items makes only incremental progress; collectively, they contribute to our long-term goal of reducing the interference that we at the FCC unfortunately helped to create.