F.C.C. 69-1176

BEFORE THE

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

In the Matter of AMENDMENT OF PART 73 OF THE COMMISSION'S RULES AND REGULATIONS TO PERMIT STANDARD BROADCAST STATIONS OPERATED BY REMOTE CONTROL TO TRANSMIT TELEMETRY SIGNALS DIRECTLY RELATED TO THE TECHNICAL OPERATION OF THE BROADCAST STATION.	Docket No. 17873 RM-320

REPORT AND ORDER

(Adopted October 29, 1969)

BY THE COMMISSION: COMMISSIONER ROBERT E. LEE ABSENT; COMMISSIONER JOHNSON DISSENTING.

1. This proceeding was initiated by a notice of proposed rulemaking, adopted November 15, 1967, in response to a petition filed by Moseley Associates, Inc., of Santa Barbara, Calif. This firm has developed a system by which transmitter meter readings and other information pertinent to the supervision of the technical operation of a standard broadcast station, can be transmitted to a remote control point by means of tones amplitude modulated directly on the carrier of the broadcast station. Moseley proposed that the frequencies of these tones be restricted to a band of 20 to 36 c./s., and that the modulation amplitude not exceed 10 percent. It was Moseley's contention that within these parameters, a broadcast station could transmit such tones simultaneously with its regular programs without compromising the technical quality of such programs, or causing annoyance to listeners. The employment of such a system would free the station licensee from his dependence on wire lines for bringing transmitter operating data to a remote control point, and make for greater reliability of operation, and a reduction in operating expense.

2. While the Commission has followed a consistent policy of rejecting proposals to utilize the broadcast carrier for purposes other than broadcast program transmission, it held that, in this case, Moseley's proposal was basically related to the broadcast function, and otherwise had sufficient merit to justify its consideration in a rulemaking proceeding. Rules were proposed which specified the technical parameters set forth by the petitioner, but comment was requested as to whether the 10-percent modulation ceiling could or should be further restricted. A rule was proposed to insure that the addition of the telemetry signal would not result in overmodulation, and rules generally requiring that such data transmission not produce a sensible degradation of program quality or effects resulting in harmful inter-

ference to other broadcast stations. In addition to the comments it requested on these proposed rules, the Commission asked for information as to the accuracy of indication of type approved AM modulation monitors when the envelope contains frequencies in the 20 to 30 c./s. range, and as to whether automatic gain control amplifiers and peak limiters might affect the accuracy of the telemetry system.

3. While December 26, 1967, and January 5, 1968, were set as the final dates for filing comments and reply comments, respectively, at the request of the parties several extensions of time were granted by appropriate Commission orders, the last dates for filing comments being set as January 16, 1969, and for filing reply comments, January 30, 1969.

4. Subsequent to these dates, the Consumer Products Division of Electronic Industries Association (EIA), on April 3, 1969, filed a motion, which embodies further comments, and a request for the late acceptance of this document. Since EIA's motion contains information important to the resolution of this proceeding and its acceptance will not prejudice any other party, it will be accepted and considered with other timely filed comments.

5. Twenty-one parties participated in this proceeding, viz.:

WMBO, Auburn, N.Y.
KGMI, Bellingham, Wash.
Mt. Washington TV, Inc.
WSM, Nashville, Tenn. (WSM)
WKIK, Leonardtown, Md.
Montana Power Co.
KTMS, Santa Barbara, Calif.
Marti Electronics (Marti)
Moseley Associates, Inc. (Moseley)
Columbia Broadcasting System, Inc. (CBS)
Bonneville International Corp.
WSAU, Wausau, Wis.
WKBH, LaCrosse, Wis.
KEEE Radio, Nacogdoches, Tex.
James Greenwood, chief engineer, WTAE AM–FM
National Association of Broadcasters (NAB)
Collins Radio Co. (Collins)
WGN Continental Broadcasting Co. (WGN)
Electronic Industries Association (EIA)
Radio Corp. of America (RCA)
Gates Radio Co. (Gates)

The majority of the participants filed formal and timely comments; in some instances pertinent information was contained in petitions for extension of time. Moseley Associates, Inc., and the National Association of Broadcasters filed reply comments. NAB's document is properly a supplement to its earlier filed comments, and, as such, is late. However, in the circumstances it will be accepted.

6. At least half of the filings, principally by broadcast station licensees, contained no technical information, but consisted principally of testimony as to the need for a telemetry system such as contemplated by the proposed rules to improve the reliability of meter readings reproduced at remote control points.

7. Technical data with respect to the performance of type approved modulation monitors were submitted by several parties. While we

do not have information on all such types of monitors, there would appear to be no general problem with respect to the response of such monitors in the range 20 to 30 c./s., although Collins points out that in the monitors it tested reliance must be placed on the peak indicator in assessing the total effect of tone and program modulation—even when a sinusoidal signal was substituted for the program portion of the envelope there was a considerable error in the indication of the semi-peak meter of the total effect of this signal and the telemetery tones. Moseley calls attention to the importance of avoiding overmodulation of negative peaks, not only because spurious signals may be emitted, but, under such conditions, the reliability and accuracy of the remote indications transmitted by the system is compromised.

8. Various makes and types of transmitters have been modulated with low frequency tones in the range proposed both in house and in field tests, and no difficulty in achieving the desired degree of modulation has been reported.

9. With respect to another question on which we requested specific comments—the effect of automatic level control amplifiers and peak limiters on the telemetry system, it appears that there are adverse effects if the telemetry tones are injected into the program line at a point where these circuit components would operate on the tones. However, as Moseley, McMartin, and others point out, the proper point for injection of the tones is after program limiting has taken place. To avoid possible overmodulation resulting from injection at this point at least one of the available telemetry systems automatically reduces the program level by 0.8 decibel during the periods when tones are being injected.

10. To make such systems function reliably with low levels of tone modulation it has been found necessary to insert a high-pass filter in the program line to minimize the presence of program components falling in the frequency range encompassed by the telemetry signals. It was demonstrated that this can be done without jeopardizing the ability of the transmitter to meet the requirements of section 73.40(a)(4) of the rules as to its audio frequency transmitting characteristics. Where such a filter is employed it should be retained in the program line when equipment performance measurements are made pursuant to section 73.47 of the rules.

11. In this proceeding we are primarily concerned with the formulation of rules which will insure that a telemetry system of the type discussed will not adversely affect the quality of programs broadcast by a station using the system, or produce harmful interference to other stations. On the other hand, if the modulation of tones on the broadcast carrier for telemetry purposes is authorized but the restrictions placed on such use are so great as to effectively preclude the operation of a feasible system, or severely limit its utility, the adoption of such rules is an exercise in futility.

12. The range of telemetry tones and the maximum percentage of modulation of these tones set forth in the proposed rules are those requested by Moseley. The only substantial area of controversy revolves around whether a telemetry system can operate within these parameters without causing a substantial derogation of program quality.

13. RCA initially raised this question in its request for additional time to file comments, filed March 25, 1968, in which it stated "* * * laboratory tests just completed on AM receiving equipment indicate that transmission of telemetry tones in the proposed frequency range at amplitudes above 2 percent may cause serious interference with reception by high fidelity AM receivers during main program lulls and during low amplitude program transmissions." It requested additional time in which to conduct field tests.[1]

14. In a motion filed on July 26, 1968, EIA opposed "adoption of the proposed rule at this time." It based its opposition on the results of—

(*a*) Laboratory tests by six EIA member companies, which included measurements and listening tests with standard signal generators "with simultaneous and sequential modulation with program material and simulated telemetering tones. It was unanimously concluded that 10-percent modulation by the telemetering tones would cause serious deterioration of the received signal for many types of receivers, including better grade table radios. It appeared that a modulation level of about 2 percent maximum might be acceptable * * *".

(*b*) Field tests at Chicago, Ill., and Pittsburgh, Pa., were conducted on June 17, 1968, and July 15, 1968, respectively. WIND, Chicago, and WTAE, Pittsburgh, transmitted the signals for these tests, pursuant to Commission authorizations. In both tests, audio oscillators were used to simulate the telemetering tones, which were transmitted separately and simultaneously with various kinds of program material with tone modulation percentages of 10, 5, 2, and 1. Tone frequencies between 35 and 20 c./s. were employed. Listening observations were made on a variety of receivers, including large consoles. EIA reports that at Chicago noticeably distortion and interference was observed on console receivers at 2-percent tone modulation, and the tones were objectionable at 1 percent with voice modulation and in program pauses. It also found 2-percent tone modulation "quite noticeable and objectionable on table and portable receivers and one car radio * * *".

15. At Pittsburgh EIA found the "overall effect * * * considerably less objectionable" than at Chicago, but noted that "on the two consoles used, critical listening could observe the presence of telemetering tones at 5 percent modulation during high percentage modulation of piano music or speech."

16. "The intermodulation effect using a 2-kHz tone at 30 percent modulation and the telemetering tones at 2 percent modulation was observable on the consoles. This effect was also clearly audible on several table radios." [2]

17. "During several of the tests utilizing 10 and 5 percent modulation by the telemetering tones and high percentage modulation with popular music, several small portable receivers exhibited signs of blocking and motorboating due to the tones." [2]

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[1] In a pleading filed on July 26, 1968, RCA stated that it had decided to coordinate its field tests and comments through EIA, and accordingly would file no separate comments.

[2] We quote these two results, since they are presented by EIA as having a significant bearing on the problem. In our view, the intermodulation test demonstrated only that, at least under the conditions of the test, transmitter or receivers were demonstrating con-

18. Prior to the initiation of this proceeding, in support of the Moseley petition, WSM, Nashville, Tenn., had conducted field tests, pursuant to Commission authorization, of telemetry with low frequency tones, using Moseley's equipment. Tests were run intermittently over a 90-day period, ending July 23, 1964. Tones between 22 and 36 cycles were employed with modulation of from 5 to 10 percent. The results of these tests were reported to the Commission on December 2, 1964. Among the conclusions reached, WSM stated: "Listening tests did not reveal any interference to our normal program service from the telemetering signals."

19. Field tests were conducted by WGN, Chicago, Ill., on January 9, 1968, and the results thereof were reported in an engineering statement appended to the comments filed by WGN Continental Broadcasting Co. in this proceeding. In these tests continuous tones were used over the range 20–36 c./s., at 5 and 10 percent modulation, and aural observations were made at seven different locations by WGN engineering personnel and officers, on 14 different broadcast receivers considered to be a representative sample of present day receivers. Various types of program material were employed. WGN reports "the consensus of the monitoring personnel at the remote locations was that the inserted telemetry signals were perceptible. The 5 percent modulation being much less perceptible to the monitors, and therefore, has much less possibility of public annoyance." (WGN supports the proposed rules subject to the reservation that modulation by the telemetry signals be limited to 5 percent.)

20. On the basis of the material filed by EIA and its opposition to adoption of the proposed rules, NAB and Moseley concluded that further field tests were necessary, and, the time for filing comments having run, NAB filed a petition on August 21, 1968, for additional time in which to conduct these tests. A Commission order, adopted September 9, 1968, set a new deadline for additional comments as January 6, 1969, and for reply comments as January 20, 1969.

21. On January 16, 1969, Moseley filed with its comments the results of a test conducted in conjunction with KTMS, Santa Barbara, Calif. This test was conducted over a 5-day period, with tones having a duration between 2 and 4 minutes being placed on the KTMS carrier at half-hour intervals, except on the fourth day of the series, when no tones were used. KTMS carried its regular programs. Tones of 29 and 35 c./s. were employed the first and second days, the first day at 5 percent modulation and the second day at 10 percent. On the third day 29 c./s. at 10 percent was used, with 22 c./s. at 3 and 10 percent during different portions of the day. The last day tones were of 29 c./s. at 5 and 10 percent and 35 c./s. at 5 percent modulation.

22. In addition to observers at Moseley laboratories and at KTMS a panel of seven listeners was recruited. These listeners were told to indicate on appropriate written forms any effects noted which detracted from the technical quality of KTMS's program transmissions.

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siderable nonlinearity, which would be reflected, in less easily observable form, in distortion of program material, even without the low frequency tones. The incipient "blocking and motorboating" exhibited by some of the small receivers, if anything, is a commentary on the extreme audio level at which these receivers were operated in an attempt to discern the presence of the low frequency tones.

During the initial days of the tests the listeners were not told specifically of what to look for. Then each was individually apprised of what was being done, and told what effects should be observed. While the panel reported several disturbances, they were either noted at times tones were not being transmitted, or were of such a nature that they could not reasonably be attributed to such transmissions.

23. NAB presented with its reply comments reports on tests concluded in cooperation with KXYZ, Houston Tex., and WFAA/WBAP, Dallas/Fort Worth, Tex. In the Houston test a 28 c./s. tone was modulated on the carrier at a 10 percent level for a 1-minute period, once every quarter hour, between 8 a.m. and 4 p.m., for a period of 7 days. Regular programs were, of course, carried by KXYZ. The conclusion to this report states:

> A cross section of receivers was used to monitor these tests by station engineering, programing, and general administrative personnel. The listening report submitted by the station states that: "During these tests there were no complaints or reports at any time that the sub-audible tones could be heard or were objectionable."

24. The Dallas/Fort Worth tests were conducted with telemetry equipment manufactured by Marti Electronics, operated so that meter readings were reproduced at three separate locations. The Marti equipment provided tones between 22 and 28 c./s., which were transmitted for 1 minute each half-hour for a period of 510 hours, at a modulation level of approximately 5½ percent. Personnel of WFAA, WBAP, and Marti periodically monitored the transmissions, using 18 different receivers, including types having extremely good bass response. The report states:

> A cross section of receivers was used to monitor these tests by station engiing, programing, and general administrative personnel. The listening report submitted by the station states that: "During these tests there were no complaints or reports at any time that the sub-audible tones could be heard or were objectionable."

25. Moseley and NAB urged that the results of these new tests provide further substantiation of their position that the proposed rules be adopted.

26. In a motion filed January 30, 1969, EIA, stated that, "because of short notice it had been unable to participate in the above described tests, and requested that further action in this proceeding be held in abeyance until such time as further joint tests could be made." It was particularly interested in the performance of the Marti telemetry equipment.

27. A further motion was filed by EIA on April 3, 1969, accompanied by a request for acceptance of late filed comments. In this motion, EIA indicated that on March 20, 1969, NAB had sponsored a field test of Marti equipment over radio station WTOP, Washington, D.C., which was observed at a receiver site in Bethesda, Md.

28. EIA stated it would withdraw its previous objections to the rulemaking proposal, subject to the following:

> (1) Telemetry tones from 20 to 28 Hz at 5½ percent modulation do not appear to cause any harmful interference.
> (2) Modulation level of tones in the 20–36 Hz range should not exceed 6 percent at any time.

(3) We still have strong reservations about the use of tones in the 30–36 Hz range at 5 percent modulation but will withdraw our objections at this time.
(4) Implicit in the above is the understanding from many discussions with FCC staff that it is FCC policy to allow no harmful interference to continue, and that complaints of such interference will be investigated and resolved on an individual basis.

We will accept EIA's late filed motion.

29. Except for EIA's Chicago tests, where the reported effects were so severe as to suggest some deficiency in the test procedure—perhaps an inaccurate setting of modulation levels—the results of the field tests, no matter by whom conducted, are not necessarily inconsistent with each other. The subjective element in all of the tests is considerable. Even though two trained observers agree an effect is perceptible, they may disagree as to the level at which it can be deemed obtrusive, and a judgment as to whether an untrained observer, not looking for the effect would notice it, or find it annoying. Our conclusions, set forth below, are based upon a full evaluation of the complete test reports, and on the reports of Commission engineers who observed the tests at Pittsburgh and Washington.

30. The perceptibility, even to trained observers, in the presence of program material of tones of fairly short duration of frequencies no higher than 30 c./s. at modulation levels approximating 5 percent is so marginal that their employment is quite unlikely to be detected by the broadcast listener. While the perceptibility of tones up to 35 cycles and with modulation percentages as high as 10 percent is undoubtedly higher, the Moseley test at KTMS with a panel of listeners indicates that a system held within these limits is unlikely to present a listener problem. Under these conditions, steady tones with modulation levels of 5 to 10 percent can be perceptible in program pauses to a listener with a receiver with extended bass response, especially so if this response is exaggerated by bass boost. We do not believe, however, that the vast majority of listeners would notice, much less be disturbed by their use, particularly since the tones, as normally employed, would be of short duration.

31. Nevertheless, if sufficiently accurate and reliable performance of the telemetry function can be achieved with modulation levels substantially less than 10 percent, and with a range of tones not extending as far upward in frequency as we have proposed, the risk is minimized that, in the exceptional case, a listener might find the tone transmissions disturbing.

32. In at least three of the tests reported (in connection with WSM, WFAA–WBAP and KTMS) the tone modulation was employed to transmit meter readings to remote points. In all three instances it was reported that when the system was properly installed and operated, satisfactory performance of the telemetry function was achieved with modulation levels approximating 5 percent. In the Dallas-Fort Worth test, furthermore, the tone range utilized was between 22 and 28 c./s. It would thus appear practical to set both the maximum modulation level and the upper frequency limit for the telemetry tones at lower figures than we had initially proposed. We shall therefore set the upper limit for the tone modulation level at 6 percent, and the

value of the highest frequency telemetry tone at 30 c./s. We believe this action should meet EIA's reservations with respect to the matter.

33. Moseley has urged that, even though satisfactory functioning of the telemetry system has been demonstrated at lower modulation levels, the 10-percent ceiling should be retained in the rules to permit its employment where low signal levels and/or noise make it necessary for reliable operation. We have no information as to the field strength of the signals in the above tests at the points the tones were utilized for telemetry purposes, or as to the minimum recovered audio level required to actuate the telemetry equipment now available. Obviously, the higher the modulation level permitted the more generally applicable will be the equipment. Usually, we believe, remote control points are at locations where the transmitted signal is reasonably strong and noise free. Sometimes this is not the case. We rather doubt in the most difficult cases (as for instance, during a period when a station may be operating presunrise with extremely low power) that the feasibility of employing such a telemetry system will hinge on whether the modulation ceiling is set at 6 or 10 percent.

34. While the proponents of this system of telemetry have emphasized the fact that the transmitted tones will be of short duration (only long enough to permit meter readings) and the Commission's evaluation of the acceptability of the system rests at least partially on the assumption that this normally will be the case,[3] in the proposed rules any numerical limitation on the length of individual transmissions, or the total duration of transmissions in any 1-hour period was intentionally omitted. The reason for this omission is that although our rules require the logging of specified operating parameters at half-hour intervals, a licensee is responsibile for the proper operation of his station on a continuous basis, and we wished to avoid the imposition of any rule which, even indirectly, might appear to limit that responsibility. Thus, should periodic meter readings reveal a possible irregularity in transmitter functioning, we would expect more frequent, and perhaps continuous monitoring of operating parameters until the irregularity is corrected.

35. On further reflection, we believe that preclusion of continuous tone transmission in normal operation can be accomplished without limiting necessary transmitter supervision by including in the rules a stipulation that the low frequency tones may only be transmitted during periods when the transmitter operating parameters are actually being observed at the remote control point. We have included such a requirement in the rules we adopt.

36. In its comments, CBS called attention to its longstanding "HomeALERT" proposal for a system under which especially designed broadcast receivers would be activated for the reception of urgent news or emergency weather warnings by the transmission of a low frequency tone by the broadcasting station to which they are tuned. This tone would be transmitted continuously during the period

[3] As pointed out by Moseley and Martl, the bandwidth of the system is insufficient to permit the transmission of modulation indications, and they must be observed at the remote point by other means. Since this is the case, there should be no occasion for the continuous transmission of the telemetry tones when the transmitter is functioning normally.

of time the receiver is actuated for the urgent announcement. The technical description of this alerting system appended to CBS's comments states that the actuating tone would be in a range between 30 and 50 c./s., and would be transmitted at a modulation level of 20 percent.

37. CBS is concerned that any rules adopted for low frequency telemetry not set technical standards incompatible with those which its proposed alerting system may employ. It suggests that its proposal and the proposal which initiated this proceeding are interrelated and should be considered together. CBS accordingly requests that we "move at once to implement a public signaling system on a basis compatible with the use of subsonic carrier tones for telemetic information."

38. As CBS is aware, its HomeALERT system is only one of a number of proposed public alerting systems which has been the subject of exhaustive study by a special working group of the National Industry Advisory Committee (NIAC). HomeALERT was one of four such systems selected for field testing some time ago, after which NIAC recommended a two-tone system employing activating tones of 853 and 960 c./s. This system is compatible with telemetry systems operating pursuant to the rules under consideration in this proceeding.

39. In response to a public notice of February 13, 1969 (F.C.C. 69–134), which set May 1, 1969, as a deadline for the submission of proposals for public alerting systems not previously examined by the special working group, the International Electric Corp. offered data on the "Cue signal system" and the Department of the Army outlined a public alerting system currently under study by the Office of Civil Defense. Neither of these systems utilizes activating tones below 100 c./s. Therefore, should one of these alerting systems be adopted, no conflict with telemetry system operation is anticipated.

40. Since it is unlikely that a public alerting system having activating characteristics similar to HomeALERT will be adopted we do not find it necessary to link AM telemetering to public alerting in the manner requested by CBS.

41. It should be noted that telemetry systems operated pursuant to these rules are quite restricted in the rate at which they can convey information and their use will be limited to remote systems utilizing visual meter observations and manual logging, or to automatic logging with a graphical record.

42. James Greenwood has suggested in his comment that the employment of frequency shift keying of the broadcast carrier for telemetry purposes not only would minimize the possibility of interference with programing but would make possible a much higher rate of information transmittal-facilitating digital readout and printout at the remote control point. He cites various tests that have been conducted which demonstrate the general feasibility of this technique.

43. By adopting these rules, which should make possible the installation of comparatively simple telemetry systems in the many stations utilizing manual logging, we do not preclude possible later consideration of other more sophisticated systems which may formally be proposed and supported by adequate technical and experimental data.

However, we do not believe that action in this proceeding should be further delayed for such consideration at this time.

44. Accordingly, *It is ordered*, *effective* December 8, 1969, that part 73 of the rules and regulations *Is amended.*

45. Authority for the rule amendments adopted herein is contained in sections 4(i) and 303(r) of the Communications Act of 1934, as amended.

46. *It is further ordered*, That this proceeding *Is terminated.*

FEDERAL COMMUNICATIONS COMMISSION.
BEN F. WAPLE, *Secretary.*