

APPENDIX A

ATMOSPHERIC NOISE DATA

This appendix contains predicted levels of atmospheric noise for frequency of 1 MHz. The predictions contained in this appendix are based on a relatively small amount of measured noise data. It is therefore advisable to consult recent noise measurements when they are available for an area under study. Data from noise measuring stations in a worldwide network are published periodically by the National Bureau of Standards, and provide valuable information when used in conjunction with the predictions.

The predicted noise level is obtained as follows:

- o Select the season and time of the day for which a prediction is desired.
- o Refer to the map that covers the season and locate time selected.
- o Locate the site on the map and determine the noise value of 1 MHz by interpolating between contour lines.

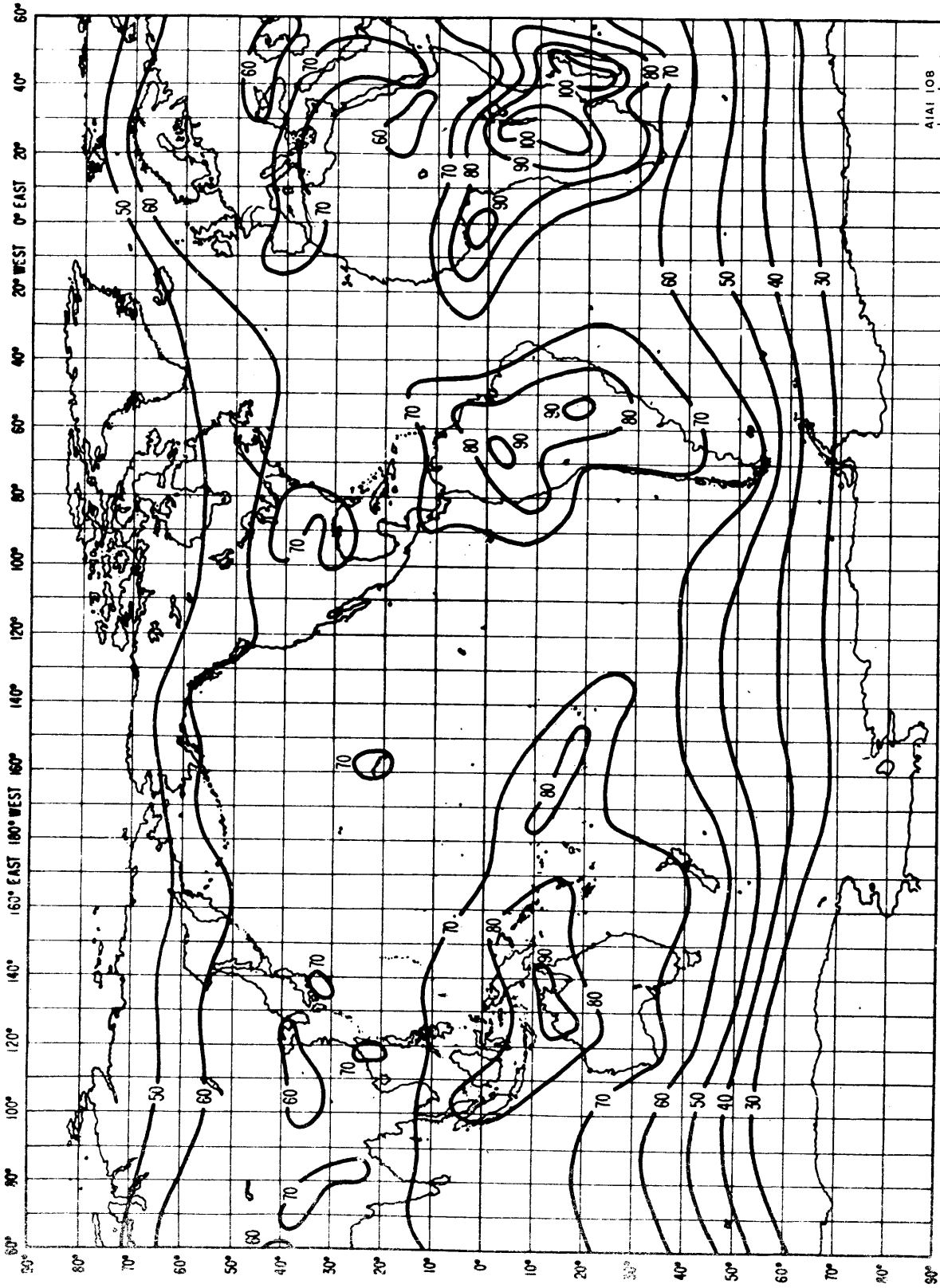


Figure A-1. Expected Value of Radio Noise at 1 MHz (December, January and February; 0000-0400 and 2000-2400)

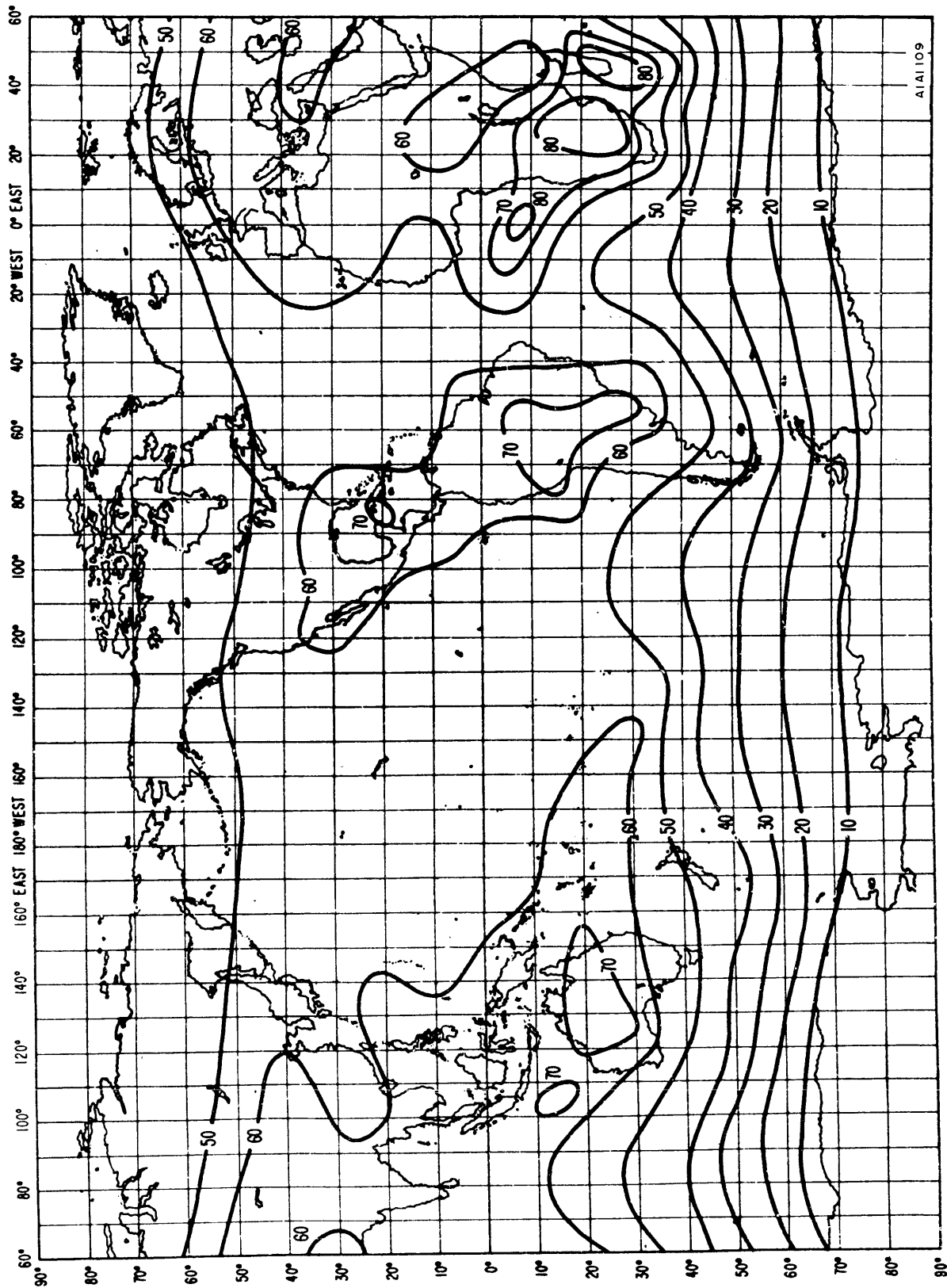


Figure A-2. Expected Value of Radio Noise at 1 MHz (December, January and February; 0400-0800)

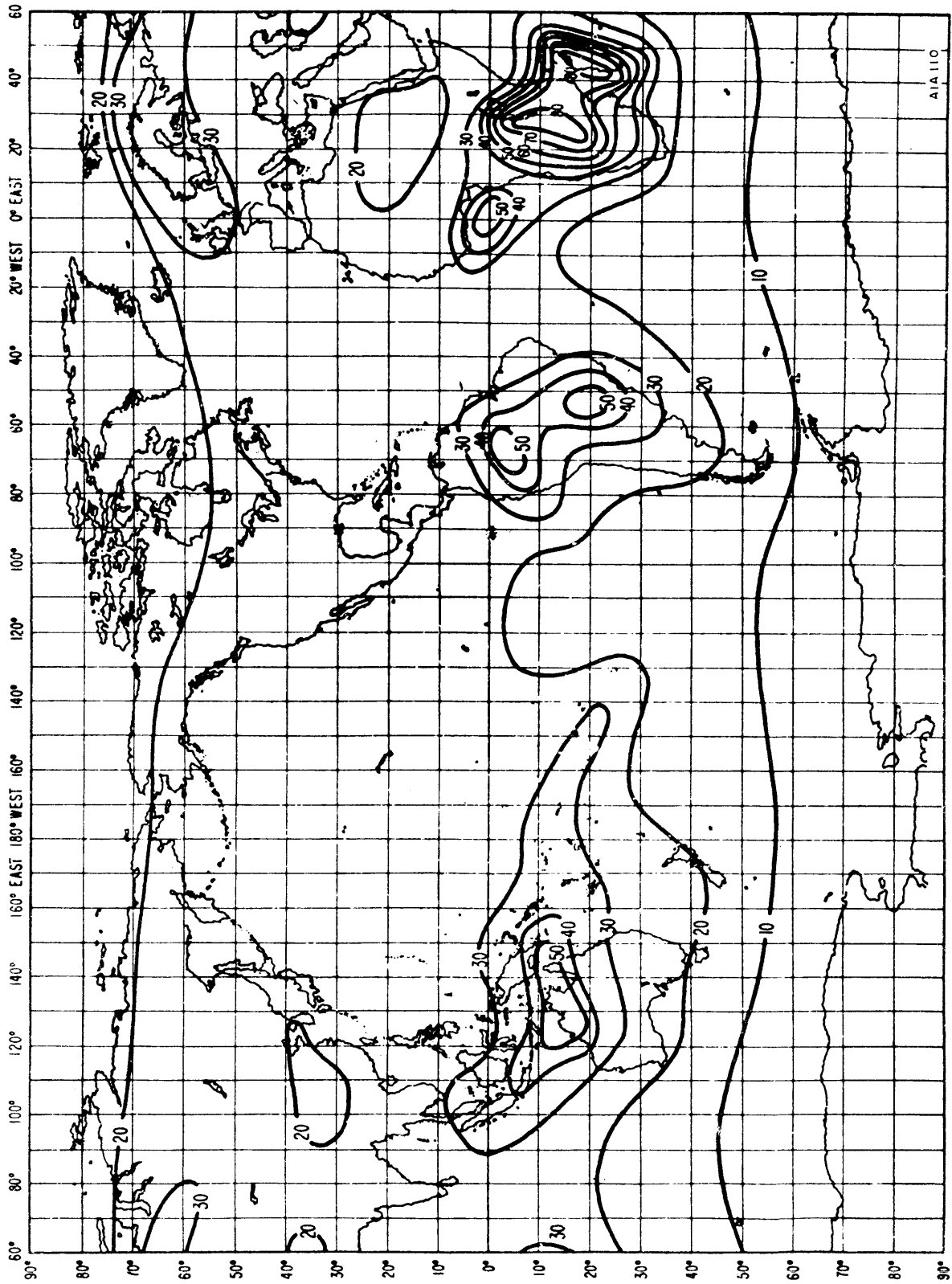


Figure A-3. Expected Value of Radio Noise at 1 MHz (December, January and February; 0800-1200)

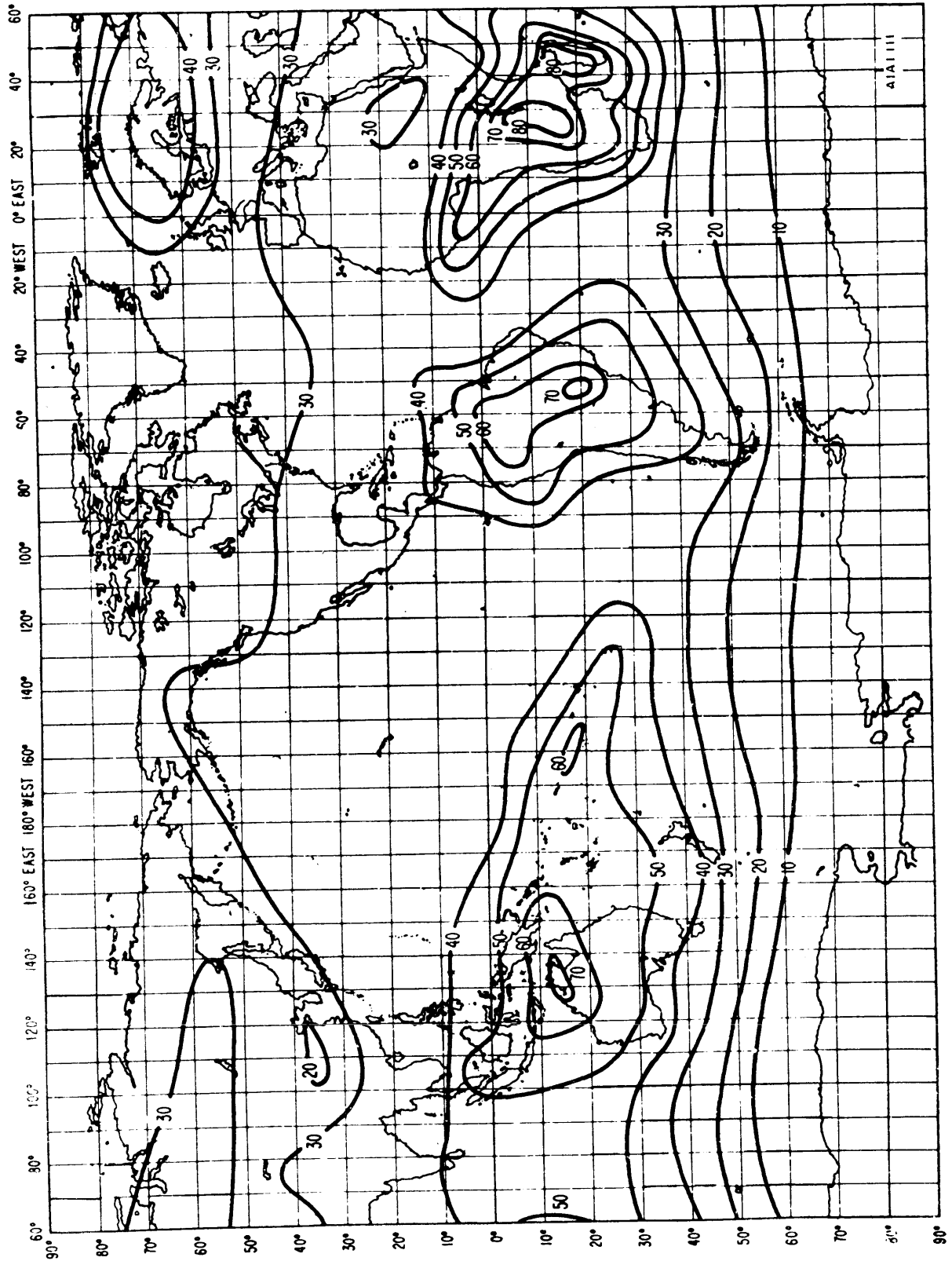


Figure A-4. Expected Value of Radio Noise at 1 MHz (December, January and February; 1200-1600)

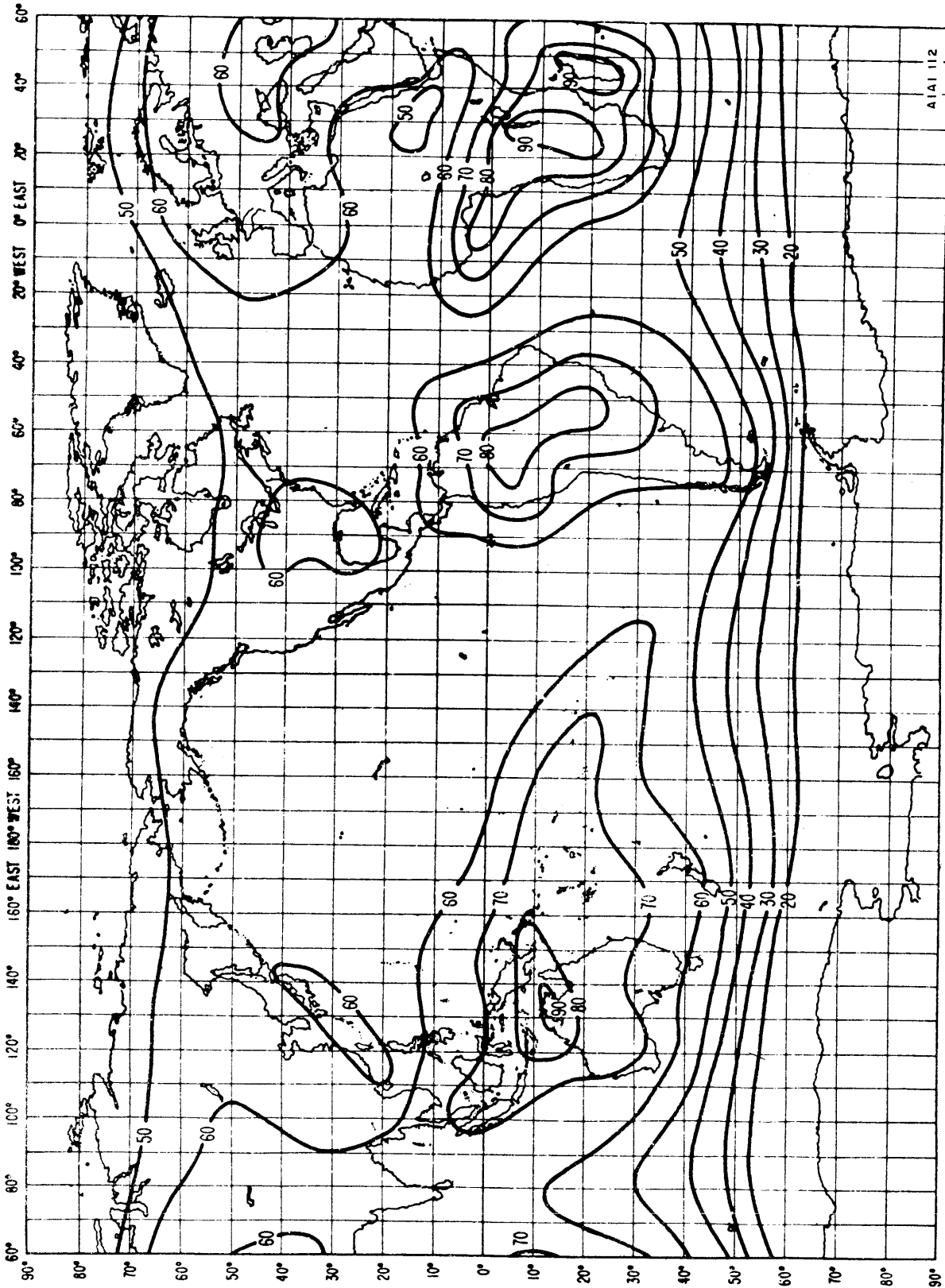


Figure A-5. Expected Value of Radio Noise at 1 MHz (December, January and February; 1600-2000)

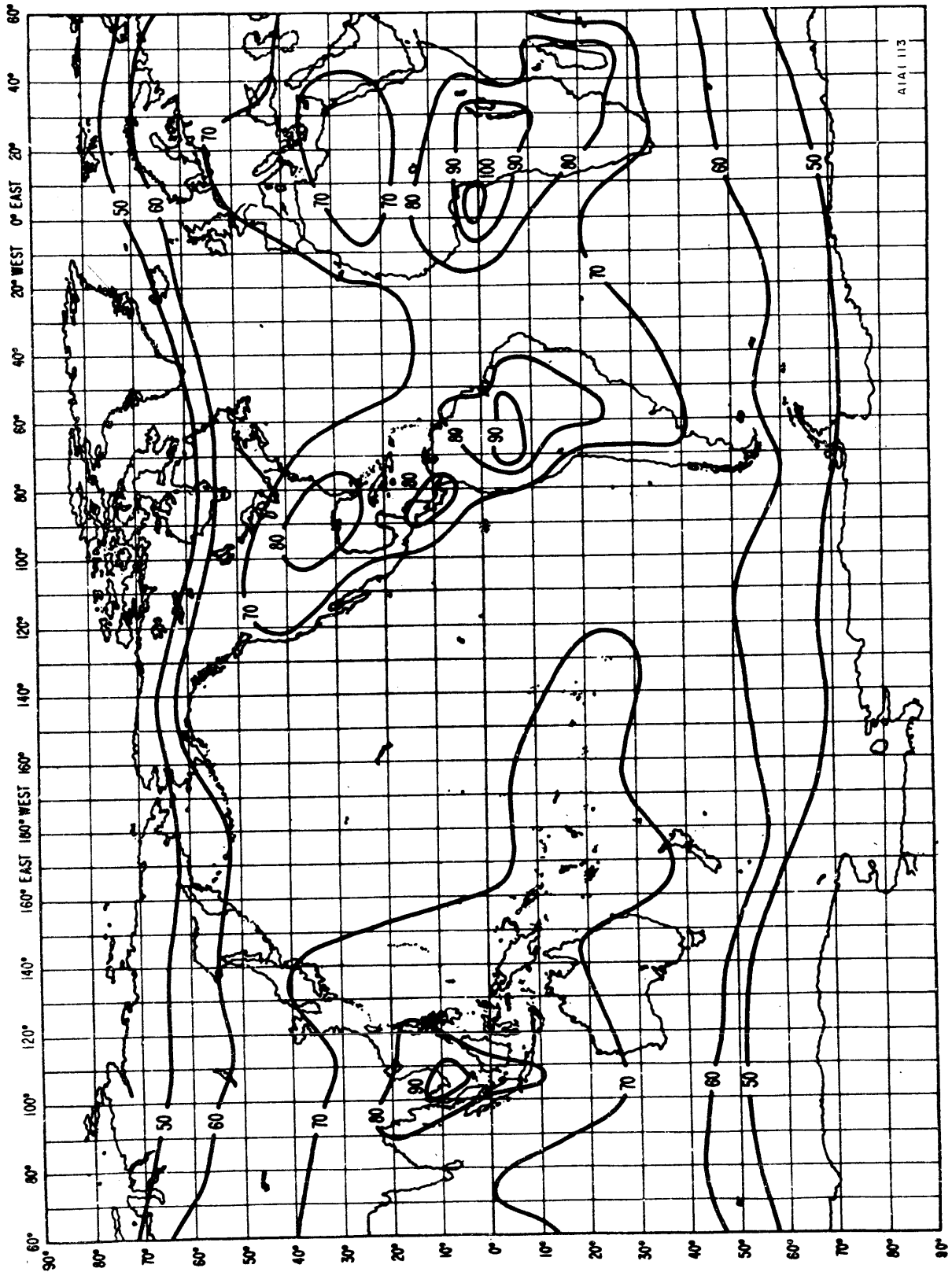


Figure A-6. Expected Value of Radio Noise at 1 MHz (March, April and May; 0000-0400 and 2000-2400)

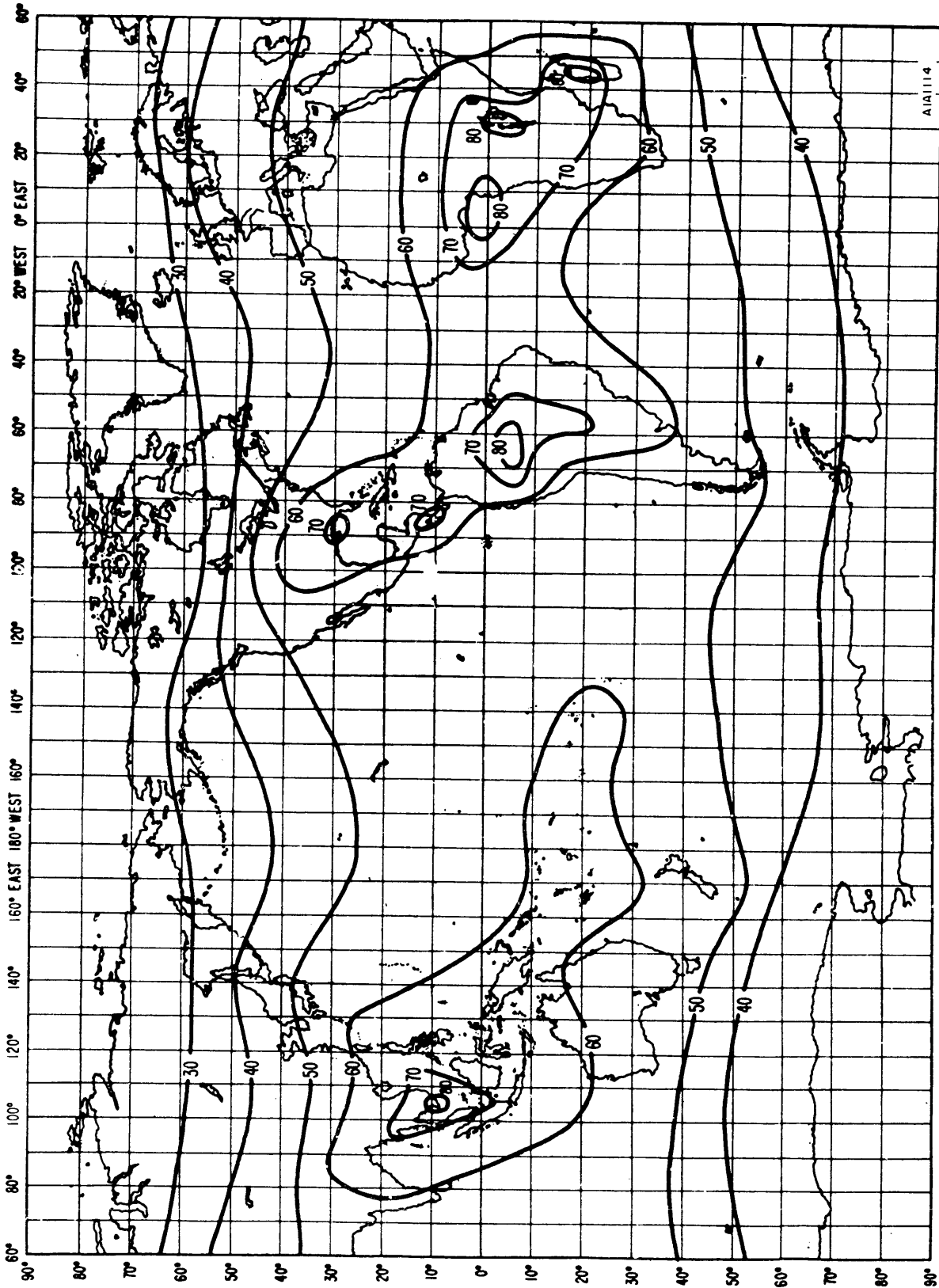


Figure A-7. Expected Value of Radio Noise at 1 MHz (March, April and May; 0400-0800)

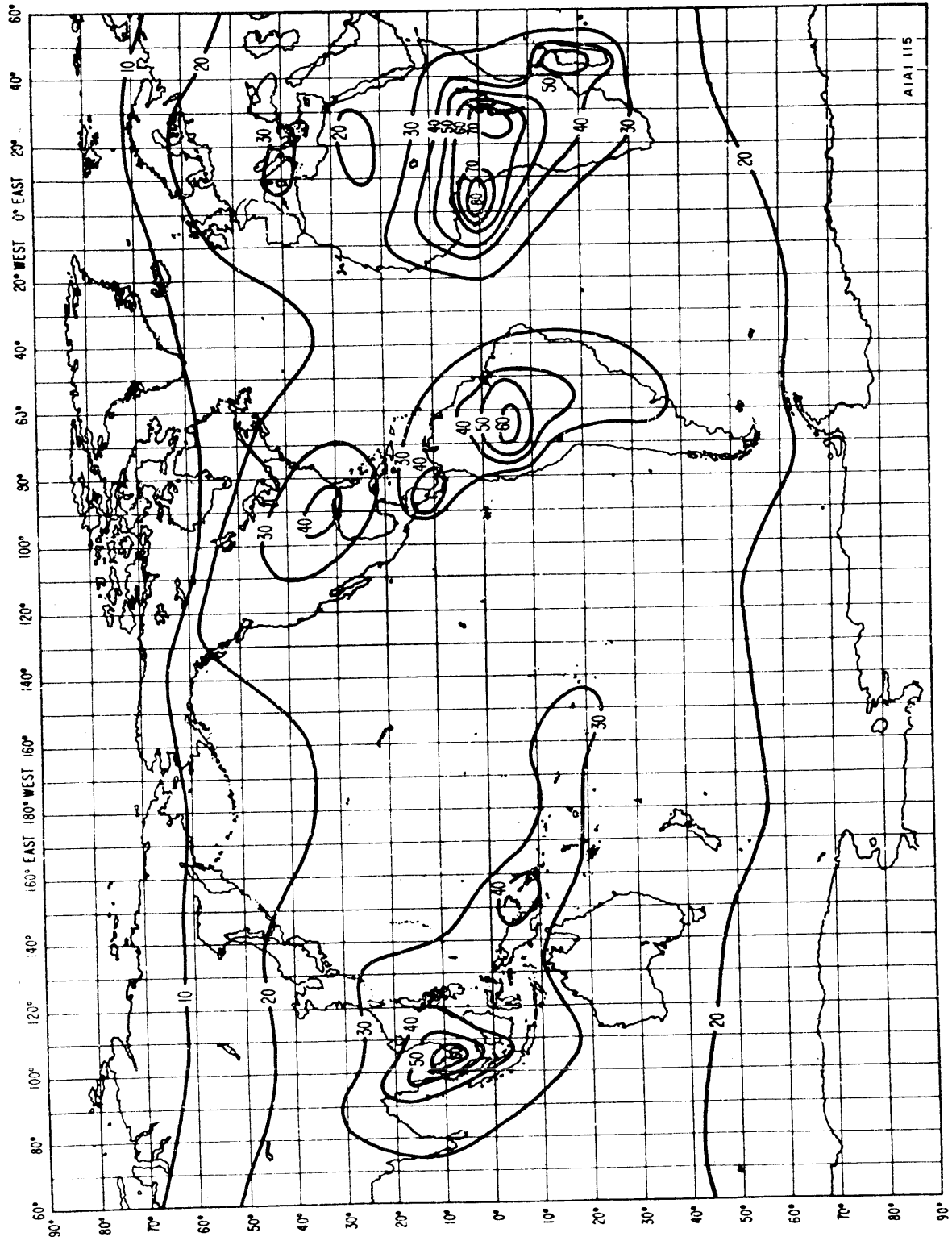


Figure A-8. Expected Value of Radio Noise at 1 MHz (March, April and May; 0800-1200)

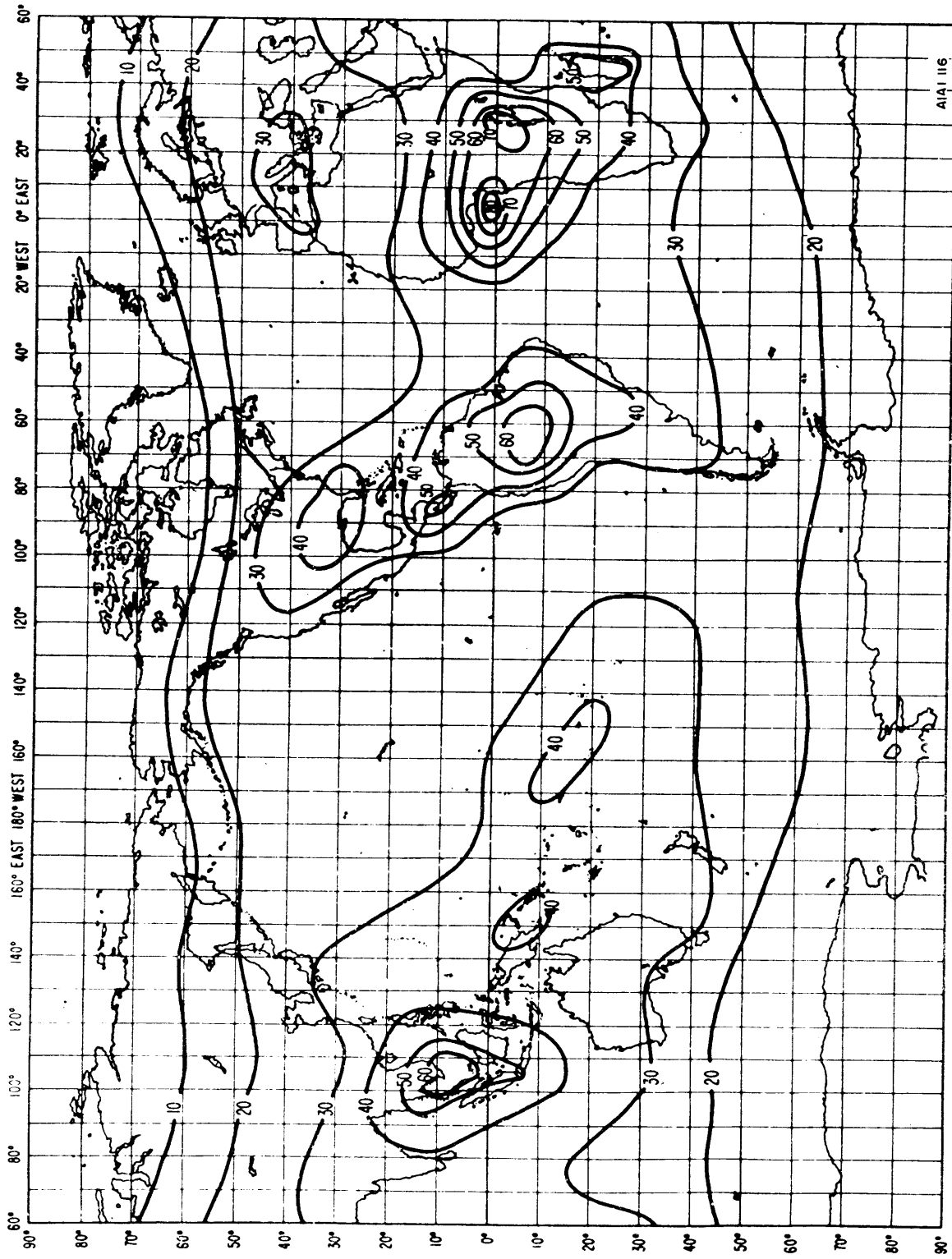


Figure A-9. Expected Value of Radio Noise at 1 MHz (March, April and May; 1200-1600)

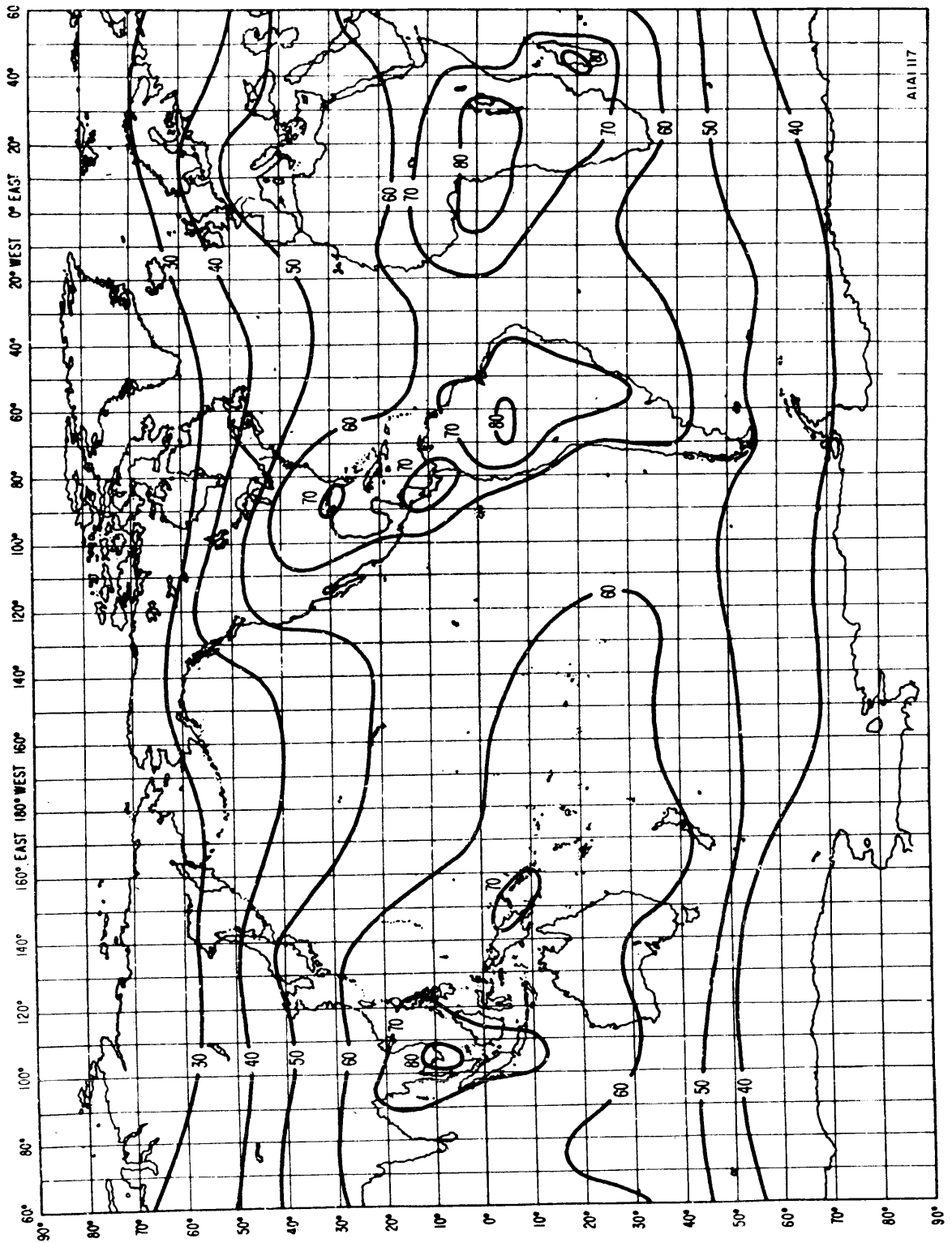


Figure A-10. Expected Value of Radio Noise at 1 MHz (March, April and May; 1600-2000)

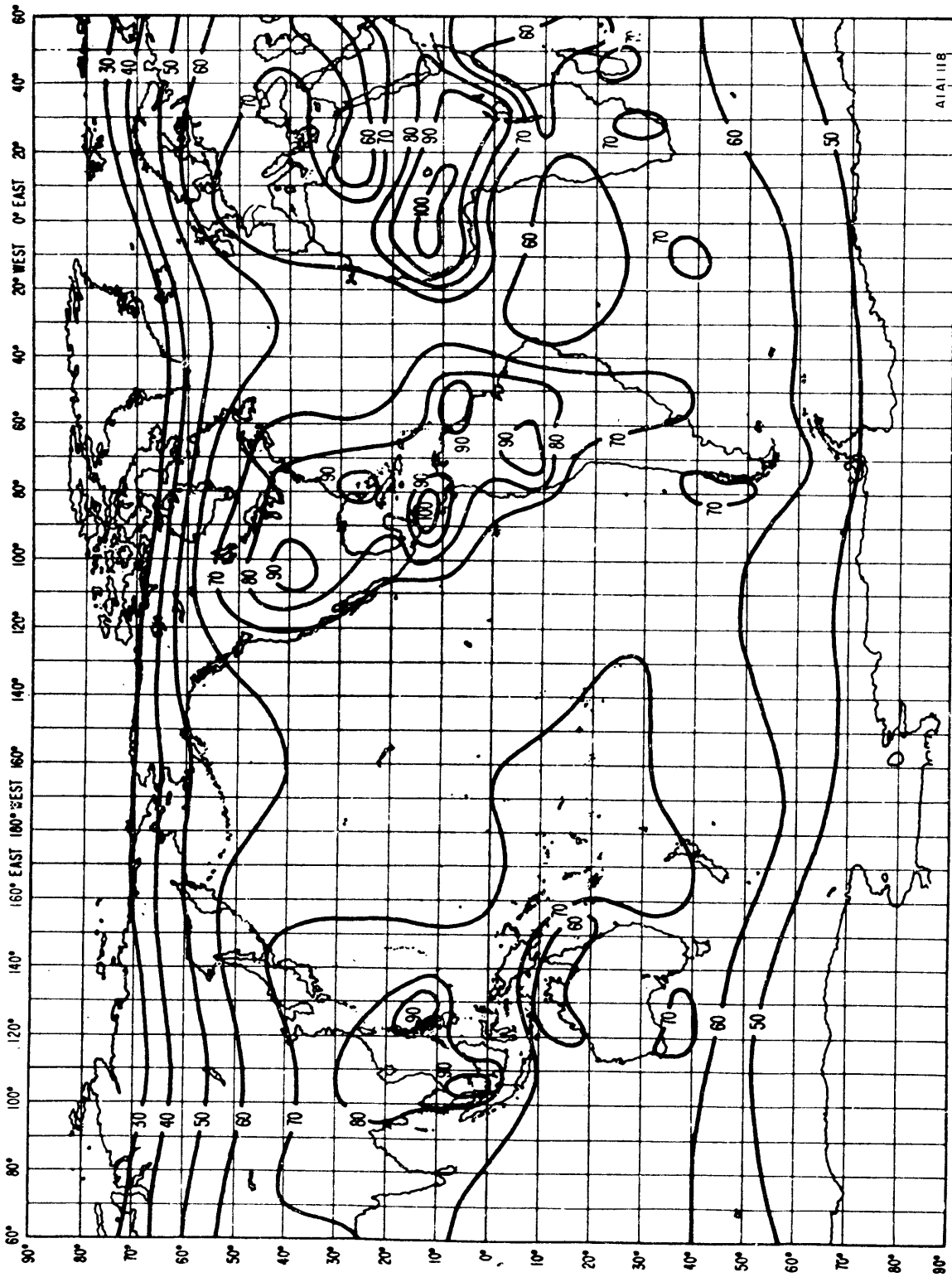


Figure A-11. Expected Value of Radio Noise at 1 MHz (June, July and August; 0000-0400 and 2000-2400)

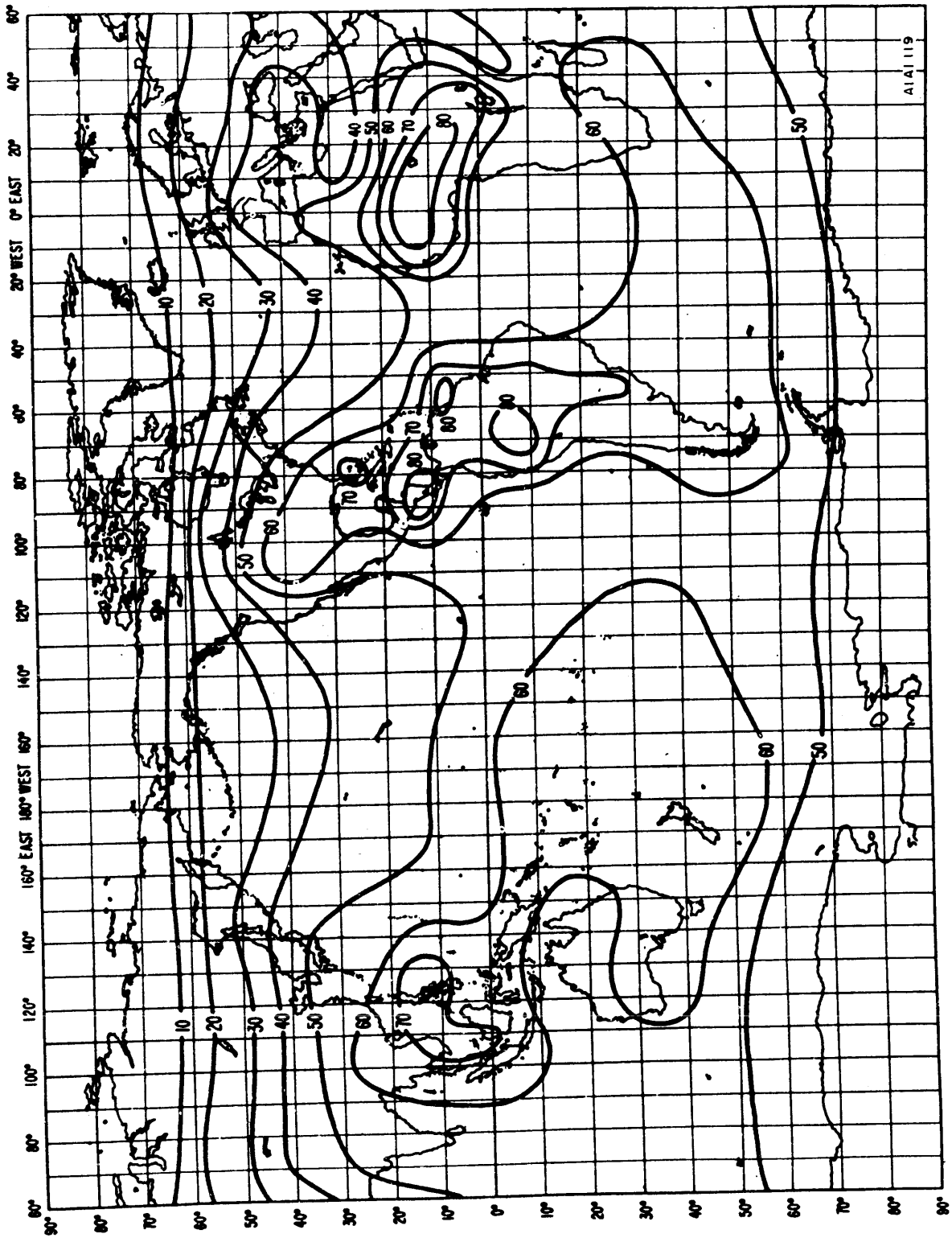


Figure A-12. Expected Value of Radio Noise at 1 MHz (June, July and August; 0400-0800)

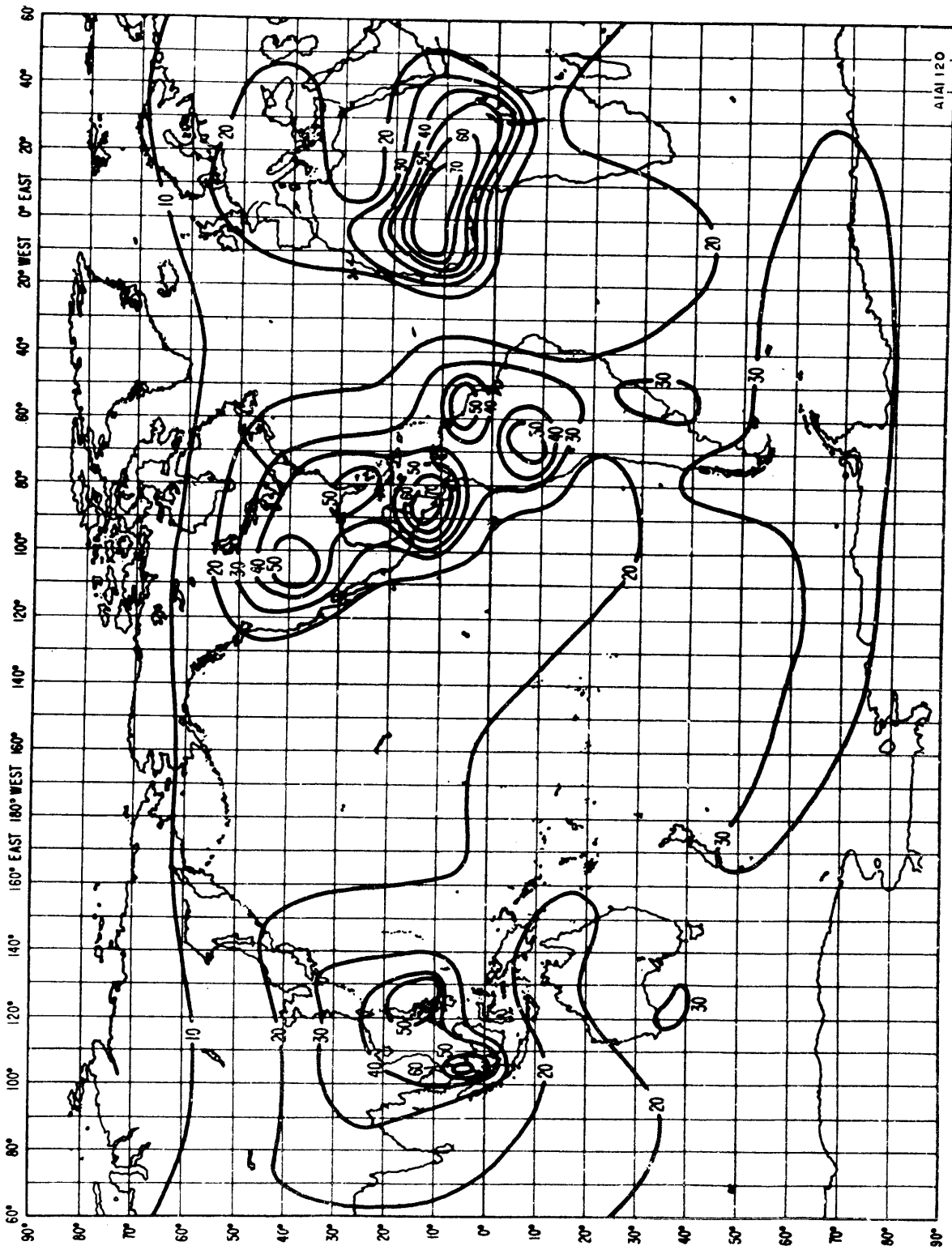


Figure A-13. Expected Value of Radio Noise at 1 MHz (June, July and August; 0800-1200)

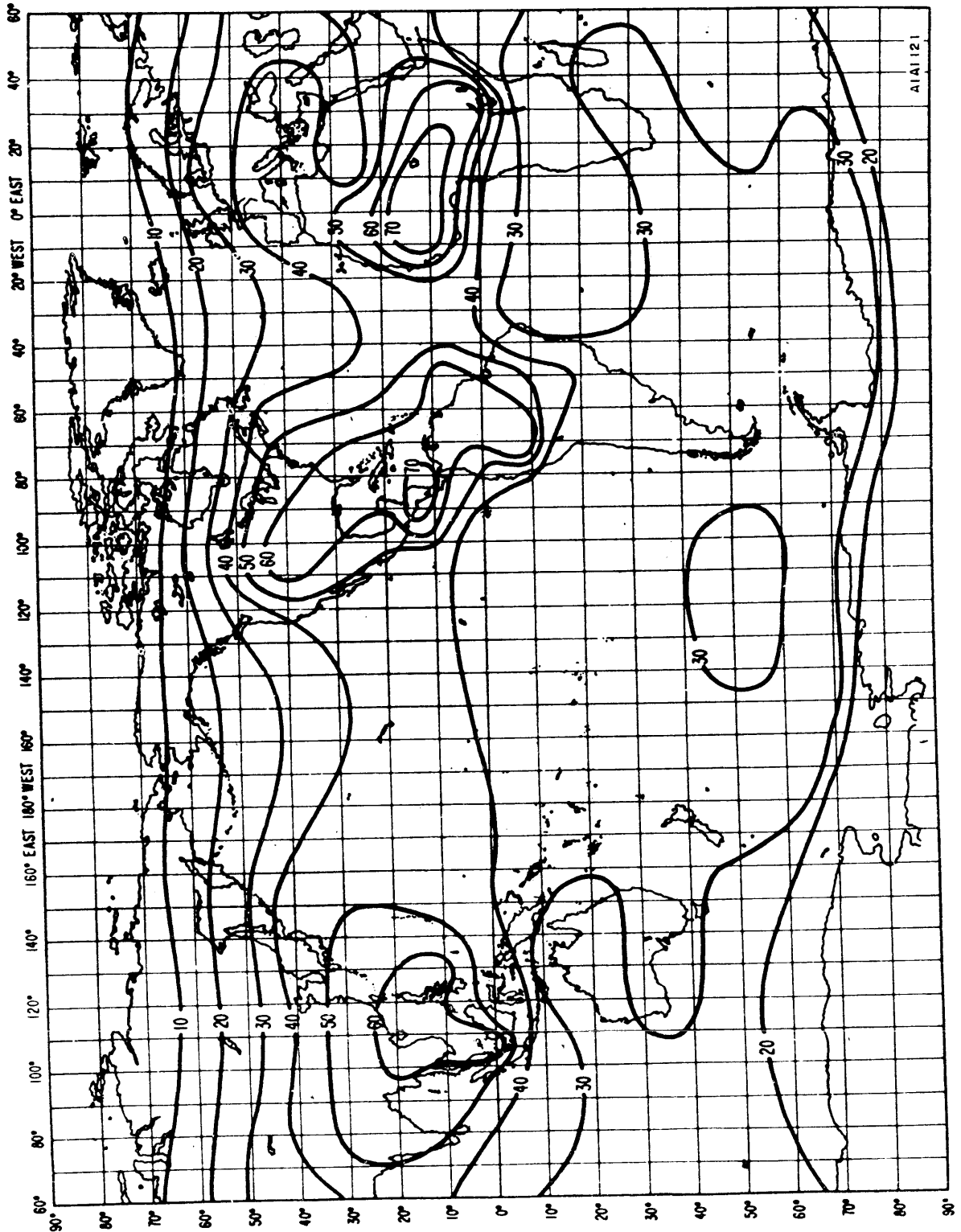


Figure A-14. Expected Value of Radio Noise at 1 MHz (June, July and August; 1200-1600)

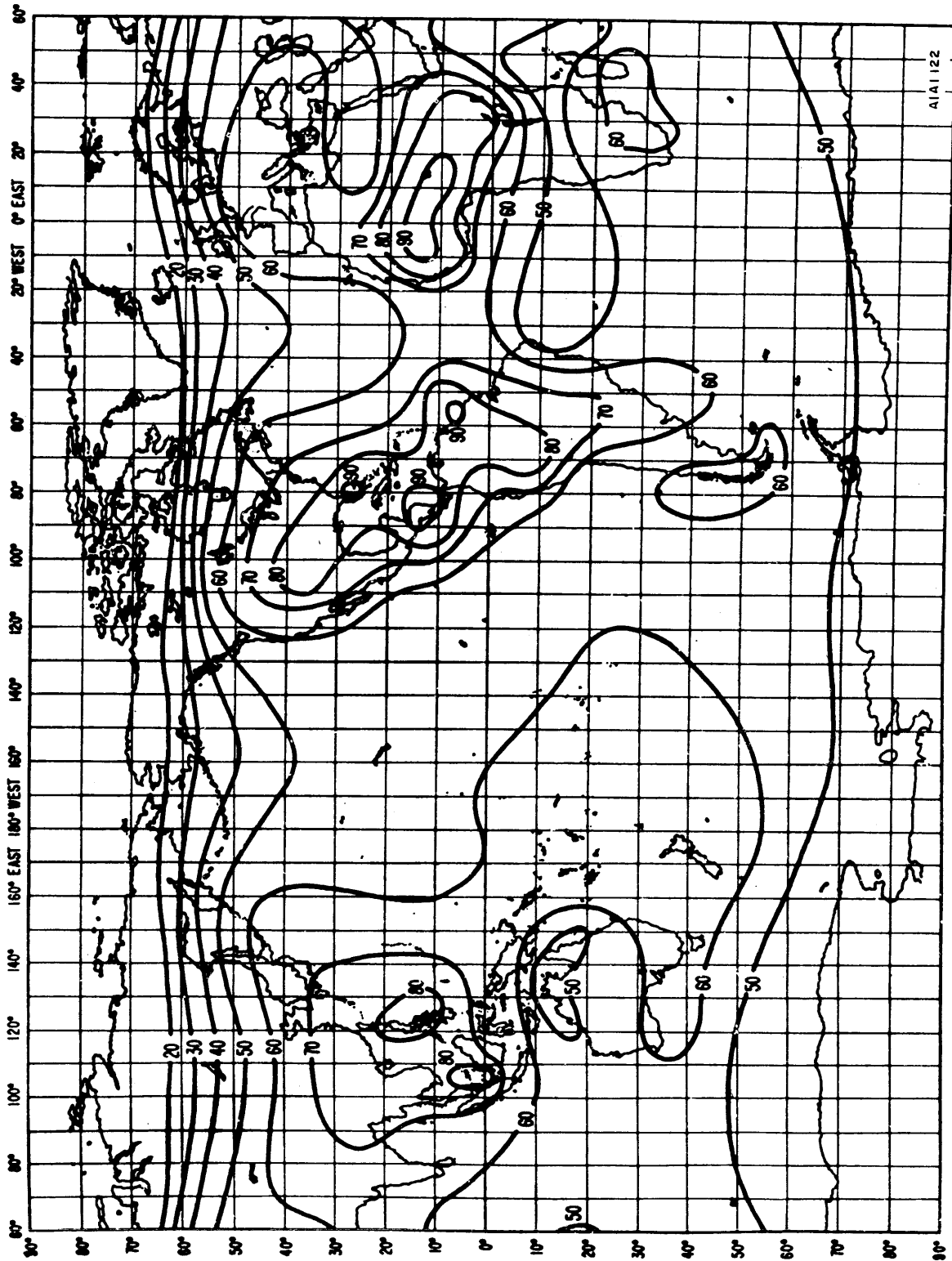


Figure A-15. Expected Value of Radio Noise at 1 MHz (June, July and August; 1600-2000)

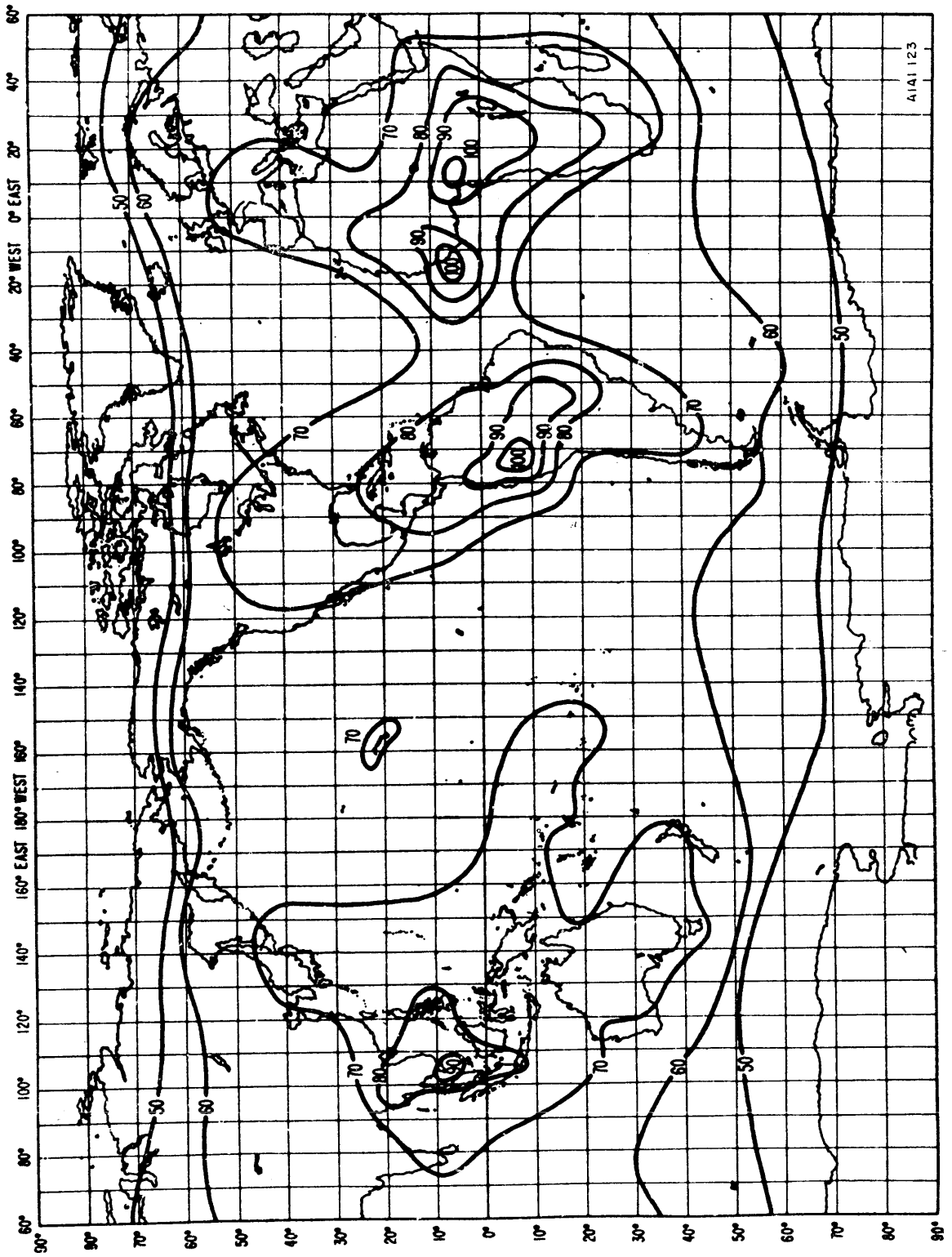


Figure A-16. Expected Value of Radio Noise at 1 MHz (September, October and November; 0000-0400 and 2000-2400)

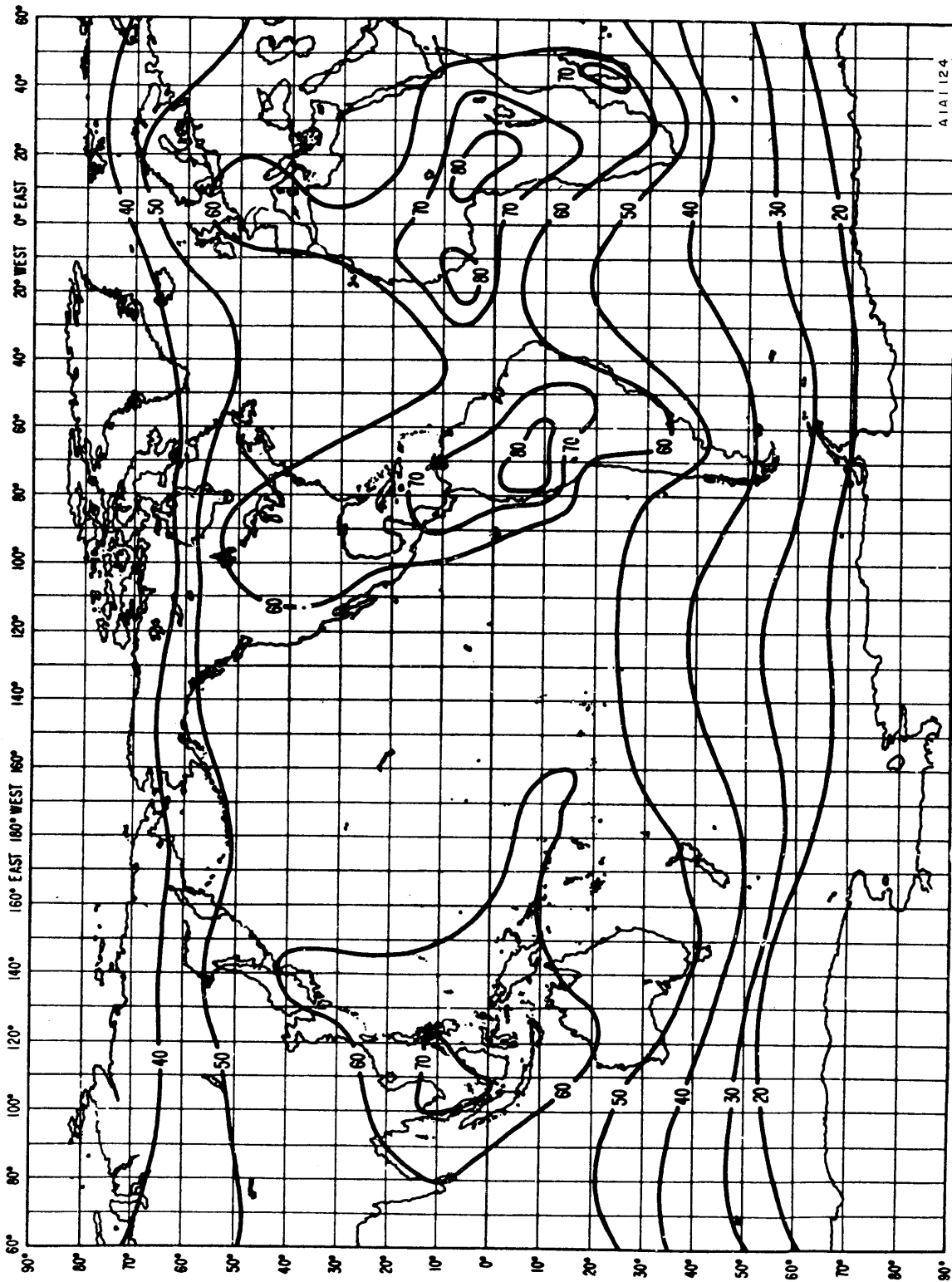


Figure A-17. Expected Value of Radio Noise at 1 MHz (September, October and November; 0400-0800)

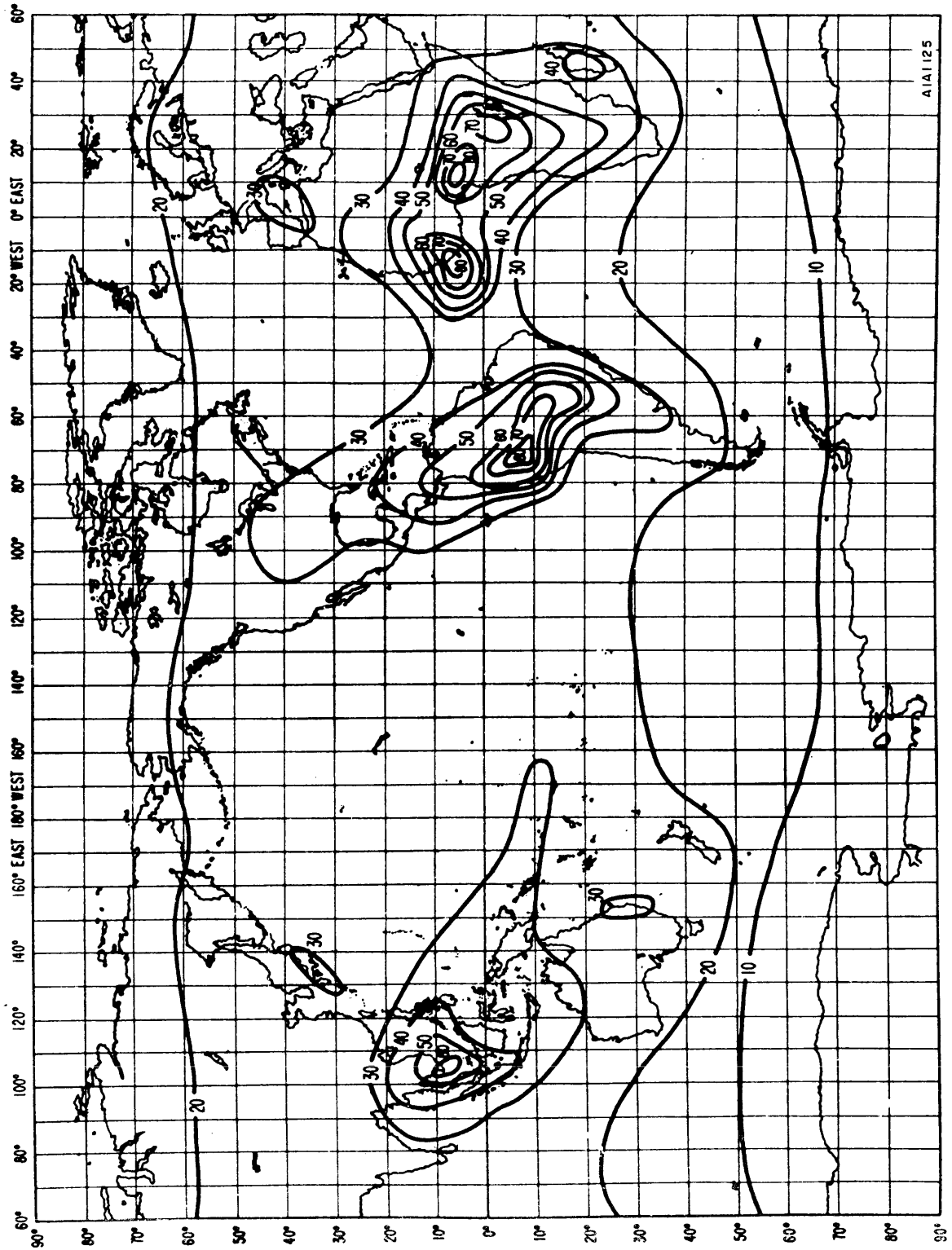


Figure A-18. Expected Value of Radio Noise at 1 MHz (September, October and November; 0800-1200)

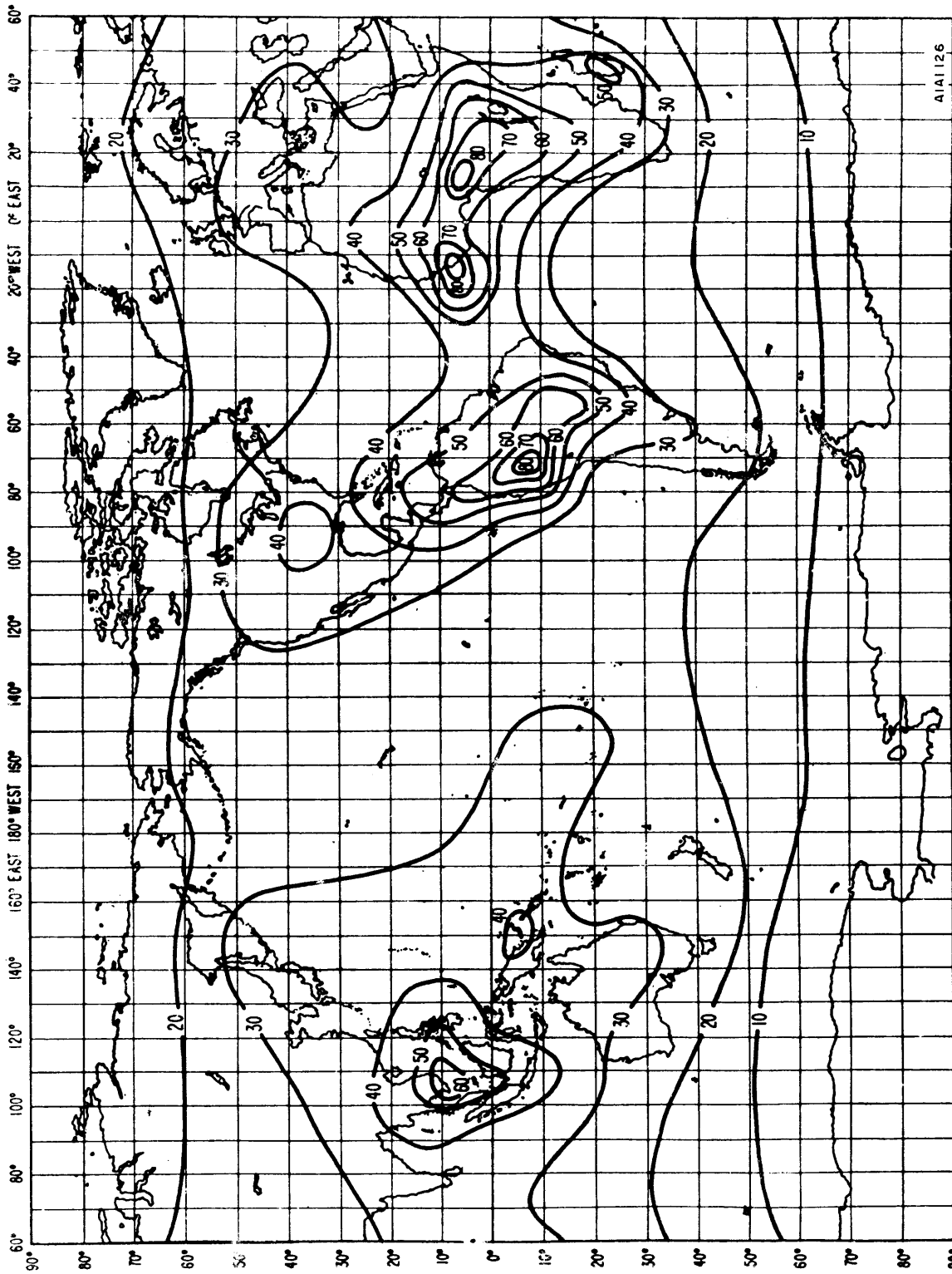


Figure A-19. Expected Value of Radio Noise at 1 MHz (September, October and November; 1200-1600)

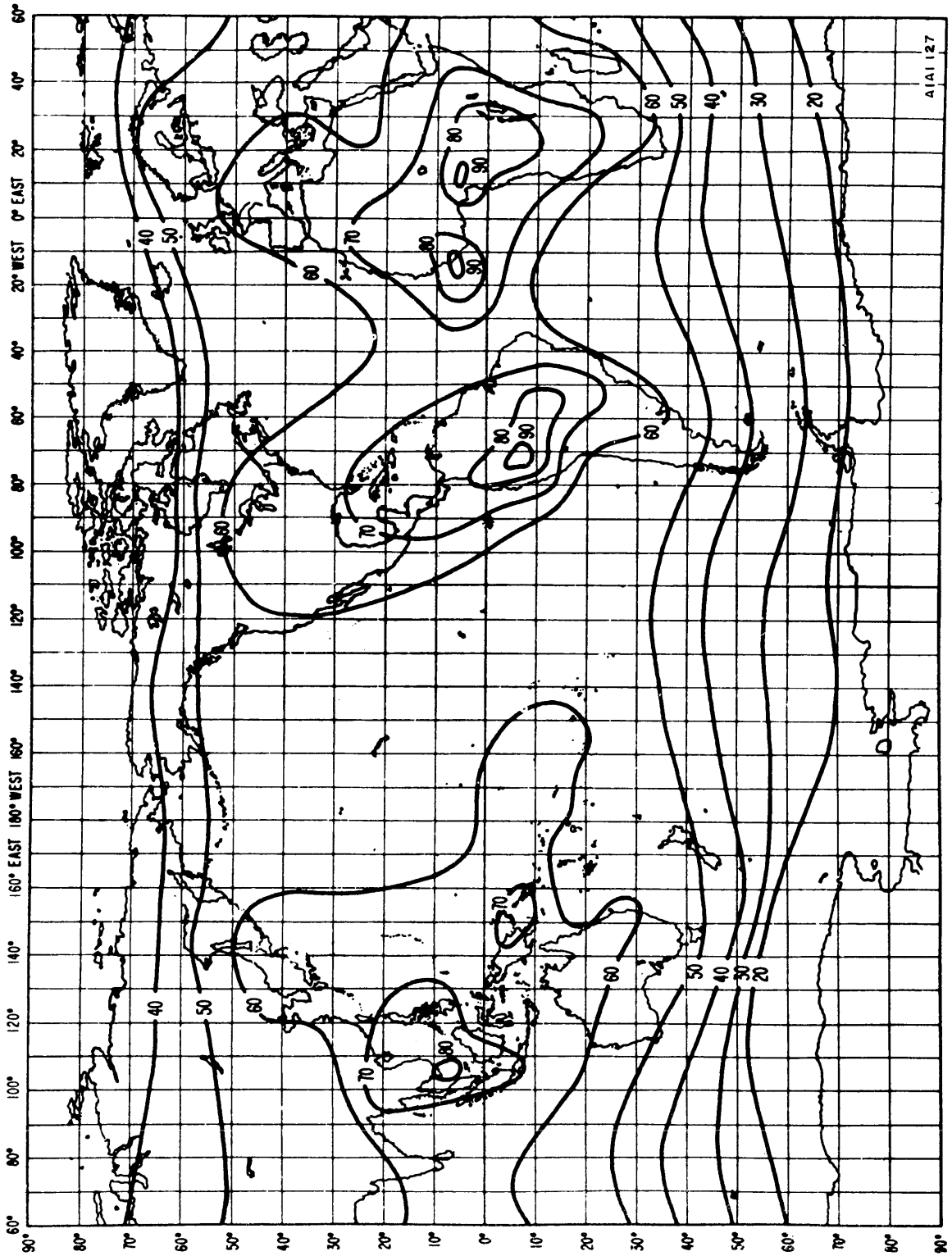


Figure A-20. Expected Value of Radio Noise at 1 MHz (September, October and November; 1600-2000)

APPENDIX B

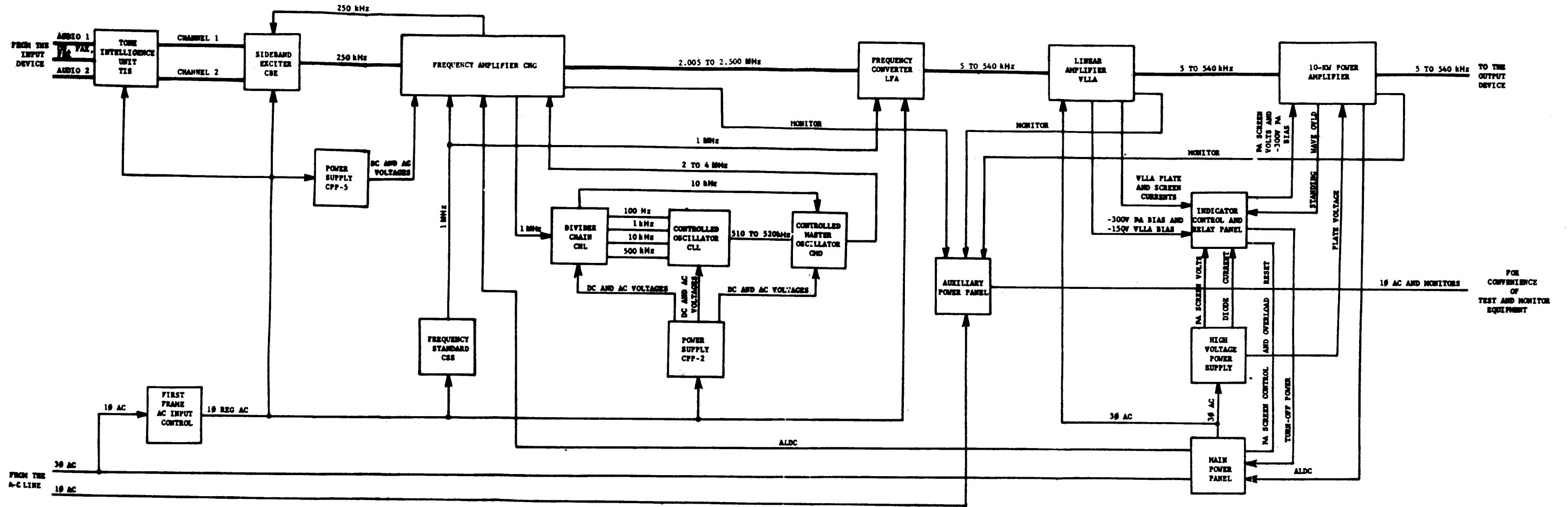
REFERENCES

1. Continental Electronics Mfg. Co., Acceptance Tests and Test Procedures, Radio Transmitter Set, AN/FRT-67, Final Report, September 1967.
2. Continental Electronics Mfg. Co., Inspection Report, Lualualei-Haiku.
3. Continental Electronics Mfg. Co., Proof of Performance Tests at VLF Summit, Final Report.
4. DCAC 330-175-1, Defense Communications Agency, MF/HF Communications Antennas, May 1966.
5. DECO Electronics, Inc., Basis of Selection of VLF Antenna Configuration, U. S. Navy VLF Communication Facilities-Pacific, April 1963.
6. DECO Electronics, Inc., Feasibility and Cost Effectiveness Studies for Modernization of Jim Creek and Lualualei VLF. Antenna Systems, Final Engineering Report NR 104-F, 1 March 1966.
7. Hoffman Electronics Corp., September 1959, State of the Art Evaluation of Very Low Frequency Communication.
8. Holmes & Narver, Inc. DECO Electronics Inc., OMEGA Facility Design Criteria Manual.
9. Holmes & Narver, Inc. & DECO Electronics Inc., VLF Radial Ground System Corrosion Tests, July 1963.
10. Gould, R. N., Very Low Frequency Electromagnetic Waves, Wireless World, April 1962.
11. Holmes and Narver, Inc. & DECO Electronics Inc., VLF System Modernization Insulator Study, May 1968.
12. IRE, Proceedings of, June 1957.
13. IRE, Proceedings of, Engineering of Communication Systems for LF Radio Frequencies, J. S. Belrose, W. L. Hatton, C. A. McKerrow, and R. S. Thain, May 1959.
14. IRE, Proceedings of, Introduction to the Theory of VLF Propagation, J. R. Wait, July 1962.
15. IRE, Proceedings of, Performance of Some Radio Systems in the Presence of Thermal and Atmospheric Noise, A. D. Watt, et al., December 1958.
16. IRE, Proceedings of, Propagation of the LF Radio Signal, J. Ralph Johler.
17. ITT Federal Laboratories, Final Report on Ultra Low Frequency Radio Propagation Modes for Reliable Long Range Communication, L. C. Broca, et al., 1959.
18. ITT Federal Laboratories, Report of Very Low Frequency Systems, J. B. Lair and A. M. Jeanjean, May 1962.
19. Jasik, Henry, Antenna Engineering Handbook, McGraw Hill Book Co., 1961.
20. Journal of Geomagnetism and Geoelectricity, An Experimental Proof of the Mode Theory of VLF Ionospheric Propagation, T. Obayashi, et al., Volume X, Number 2, 1959.
21. Laport, Edmund, Radio Antenna Engineering, McGraw Hill Book Co., 1952.

22. Mullaney, J. H., Efficiency of a 300-Foot Vertical Antenna System.
23. Mullaney & Associates, Division of Multronics, Inc., Engineering Discussions Concerning the Efficiency of a 300-Foot Vertical Antenna System in the LF Regions.
24. Multronics, Inc., Antenna at U. S. Naval Radio Station (7) Lualualei, Hawaii, Final Engineering Report, October 1966.
25. Multronics, Inc., Division of, (J. H. Mullaney & Associates), Engineering Discussion Concerning the Efficiency of a 300-Foot Tower Vertical Antenna System in the VLF Regions.
26. Multronics, Inc., Instruction Manual for NORD Antenna.
27. Multronics, Inc., NORD LF Antenna Course, 1965.
28. National Bureau of Standards Technical Note No. 300, U. S. Dept. of Commerce, Characteristics of the Earth-Ionosphere Waveguide for VLF Radio Waves, December 1964.
29. National Bureau of Standards, U. S. Dept. of Commerce, Computations of the Antenna Cut-Back Factor for LF Radio Waves.
30. National Bureau of Standards, U. S. Dept. of Commerce, IRPL Radio Propagation Handbook, November 1943.
31. NBS Circular 574, National Bureau of Standards, U. S. Dept. of Commerce, Amplitude and Phase Curves for Ground-Wave Propagation in the Band 200 Cycles per Second to 500 Kilocycles, by J. R. Wait and H. H. Howe, 1956.
32. NBS Circular 557, National Bureau of Standards, U. S. Dept. of Commerce, World-Wide Radio Noise Levels Expected in the Frequency Band 10 KC to 100 MC, W. Q. Crichlow, et al., August 1955.
33. NBS Journal of Research, Radio Propagation, Vol 63D, No. 1, July and August 1959.
34. NBS Report No. 3586.
35. NBS Report No. 5022, On the Mode Theory of VLF Ionospheric Propagation, by J. R. Wait, October 1956.
36. NBS Report No. 5037.
37. NBS Technical Note 100.
38. Naval Ordnance Laboratory, Corona, NOLC Report 721, Horizontal VLF Transmitting Antennas, Near the Earth.
39. NAVELEX 0101,102; Naval Communication Station Design.
40. NAVELEX 0101,103; HF Radio Propagation and Facility Site Selection.
41. NAVELEX 0101,104; HF Radio Antenna Systems.
42. NAVELEX SER 04322-92, Evaluation of NORD Antenna/FRT-19 System, January 1967.
43. NAVSHIPS 0967-033-8040, Radio Transmitting Set AN/FRT-72, Technical Manual.
44. NAVSHIPS 0967-046-6010, AN/FRT-73, VLF Radio Transmitter Technical Manual.
45. NAVSHIPS 0967-163-2010, Radio Receiving Set AN/SRR-19 and AN/SRR-19A, July 1966.
46. NAVSHIPS 0967-227-9010, LF Antenna Matching Equipment, Technical Manual.
47. NAVSHIPS 0967-238-9011, AN/FRT-72B(U), Radio Transmitting Set, Technical Manual, September 1967.
48. NAVSHIPS 0967-271-4010, Low Frequency General Purpose Transmitter Model GPT-10KLFF-1(AN/FRT-74), Technical Manual.

49. NAVSHIPS 0967-271-4030, Installation and Operating Instructions Model GPT-10KLF-1 (AN/FRT-74), Technical Manual.
50. NAVSHIPS 0967-8020, Maintenance Standard Book for Radio Transmitting Set AN/FRT-72A.
51. NAVSHIPS 92117, Instruction Book for Radio Transmitting Set AN/FRT-19.
52. NAVSHIPS 93716, AN/BRR-3 (U), Radio Receiving Set, Technical Manual.
53. NAVSHIPS 94592.
54. NAVSHIPS 95884, AN/FRT-64, VLF Radio Transmitter, Technical Manual.
55. NAVSHIPS 95999, AN/FRT-67, VLF Radio Transmitter, Technical Manual.
56. NELC/TR 1758, Criteria for Ship MF Transmitting Antenna Systems, April 1971.
57. NEL L-F COMM. Report on Propagation Studies.
58. NEL/REPORT 1296, U. S. Navy Electronics Laboratory, San Diego, Calif., Frequency Limitations In the Multichannel LF Broadcast, W. E. Gustafson, June 1965.
59. NEL/Report 1381, U. S. Navy Electronics Laboratory, San Diego, Calif., Low-Frequency Top-Loaded Antennas, T. E. Devaney, R. F. Hall and W. E. Gustafson.
60. NRL Memorandum Report 1783, Naval Research Laboratory, Radiation Parameters of the VLF Transmitting Station NWC, North West Cape, Australia, June 1967.
61. NRL Report 6359, Naval Research Laboratory, An Investigation of the Model Interference of VLF Radio Waves, Rhoads and Garner, October 1965.
62. NRL Report 6663, Naval Research Laboratory, Theoretical VLF Multimode Propagation Predictions, December 1967.
63. NRL Memo Report 1606, Naval Research Laboratory, Program for the Determination of the Effective Height and Radiation Resistance of the VLF Transmitting System at NAVCOMSTA, North West Cape, Australia, Garner and Rauderbush, April 1965.
64. NRL Report 6893, Naval Research Laboratory, A VLF Effective Ground Conductivity Map of Canada and Greenland With Revisions Derived From Propagation Data, Hauser, Garner, and Rhoads, March 1969.
65. NWC - NWCCCL TP No. 770.
66. NWCCCL TP 782, Naval Weapons Center, Research Dept., Seeley E. W. and Moision W. K., Horizontal End-Loaded VLF Transmitting Antenna.
67. NWCCCL TP 881, High Power VLF Transmitting Antennas Using Fast Wave Horizontal Dipole Arrays, Naval Weapons Center, Corona, Calif.
68. NWC TP 4972, Experimental Fast-Wave Dual Dipole VLF Transmitting Antenna, Naval Weapons Center, China Lake, Calif., August 1970.
69. Pickard & Burns Inc. for Continental Electronics Mfg. Co., Proof of Performance Tests Cutler VLF Antenna U. S. Naval Radio Station, Final Report, 1961.
70. Schelkunoff, S. A., Electromagnetic Waves, 1943.
71. Smyth Research Associated, A Design Study of a Low-Frequency Fleet Broadcast System, Interim Technical Report, June 1966.
72. T. O. 317-10-1-2, Vol. 2, Technical Manual - Telecommunications Performance Standards, USAF-GEEIA.
73. TRG-West, The Pan-Polar LF-VLF Antenna.
74. U. S. Department of Transportation; Atmospheric Transmission Handbook, Report No. DOT-TSC-NASA-71-6.

75. Wait, J. R., On the Calculation of Transverse Current Loss in Buried Wire Ground Systems.
76. Wait, J. R., and Pope, W. A., Input Resistance of LF Aerials with Radial Wire Earth System, Wireless Engineering.
77. Watt, Arthur D., VLF Radio Engineering. Pergamon Press, 1967.
78. Westinghouse Georesearch Laboratory, June 1970, Development of a VLF Atmospheric Noise Prediction Model, Report No. 70-1HZ-VLFNO-RI
79. NBS Tech Note 12.



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Foldout 4-1. AN/FRT-74 LF Transmitter, Block Diagram