VOLUME I

REPORT

OF THE

INTERNATIONAL ADMINISTRATIVE AERONAUTICAL

RADIO CONFERENCE

FIRST SESSION

GENEVA, 1948

Conférence internationale administrative
des radiocommunications aéronautiques
2e session

Genève 1949

4 Août 1949

CORRIGENDUM

au VolumeI(textes anglais, espagnol et russe
du Rapport de la lère session de la Conférence internationale
administrative des radiocommunications aéronautiques.

Page 8, 3e colonne,

fréquences	8956 et 8961,5
lire	8956
**	8961,5

International administrative
aeronautical radio Conférence
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CORRIGENDUM

to Volume I (English, Spanish and Russian texts)
of the Report of the 1st Session of the International Administrative
Aeronautical Radio Conference.

Page 8, 3rd column,

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read	8956
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Conferencia Administrativa
Internacional de Radio-
comunicaciones Aeronáuticas
2a Reunión

Ginebra 1949

4 de agosto de 1949

CORRIGENDUM

al Volumen I (textos en inglés, español y ruso)
del Informe de la 1ª Reunión de la Conferencia Administrativa
Internacional de Radiocomunicaciones Aeronáuticas.

Página 8, 3ª columna,

Frecuencias	8956 y 8961,5
Léase:	8956
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PREAMBLE

The International Administrative Aeronautical Radio Conference met in Geneva, on May 15, 1948.

The purposes and functions of the Conference are defined in Article 6 (c) and (e) of the Annex to the Resolution of the International Administrative Radio Conference, 1947, "Relating to the Preparation of a New International Frequency List and in the Resolution * of the Administrative Council of the Union, at its Second Session, Geneva, January, 1948.

In accordance with the Resolution of the Administrative Council, a Preparatory Committee for the Conference met in Geneva from April 27 to May 14, 1948. It prepared an agenda for the Conference and formulated recommendations as to the technical basis and methods of approach for the establishment of the allotment plan for frequencies in the bands of the aeronautical mobile service.

The Conference adopted, as its basis of work, the recommendations of the Preparatory Committee, including the following agenda :

A - Rules of procedure for the Conference. Election of officers. Admission of International Organizations.

B - Consideration of the Report of the Preparatory Committee.

C - Determination of the technical and operational principles for the allotment of frequencies in the aeronautical mobile bands.

D - Determination of principles relating specifically to the allotment of frequencies in the bands of the aeronautical mobile R service.

E - Determination of principles relating specifically to the allotment of frequencies in the bands of the aeronautical mobile OR service.

F - Establishment of the plan for the allotment of frequencies :

- for the aeronautical mobile R service.
- for the aeronautical mobile OR service.
- for special services, for example : Distress, Air/Sea Rescue, Meteorological Broadcasts, Aerodrome Control, Approach Control, etc.

* The full text of this Resolution may be found in Volume III of the Report of the First Session of the International Administrative Aeronautical Radio Conference, Geneva, 1948 as an attachment to Aer-Document 1 included therein.

G - Consideration of methods for the accomodation in the future of additional requirements in the bands of the aeronautical mobile service.

H - Consideration of the recommendation to be made to the P.F.B. relating to the carrying out of the plan established by the Conference.

I - Handling of public correspondence on frequencies of the aeronautical mobile service (see paragraph 225, Radio Regulations, 1947).

In addition, the Conference, during the course of its work, added the following questions to its adopted agenda :

J - Forwarding to the International Civil Aviation Organization of copies of complaints and reports relating to interference within the aeronautical mobile service frequency bands.

K - Coordination between Aviation and Maritime services in the field of telecommunications.

L - Publication by the I.T.U. of certain service documents.

M - Cooperation between the I.C.A.O. and the I.T.U.

Also, considering :

- that the requirements of the aeronautical mobile service can be satisfied within the limits of the bands allocated to this service by the International Administrative Radio Conference, 1947, only under the condition of the maximum utilization of the possibilities of frequency sharing between the different regions of the world; and

- that various systems of communication are used by different countries and areas for this service,

the Conference, at the beginning of its work, decided its tasks to be as follows :

a) to summarize the requirements of the aeronautical mobile service;

b) for the aeronautical mobile R service,

- to divide the world into regions, taking into account the distribution of air routes and wave propagation conditions, to obtain the maximum utilization of frequency repetition, and,

- to allot frequencies to countries and regions, bearing in mind that further allotment or assignment of these frequencies within those countries and regions will be done respectively by Administrations or by regional conferences, should the Administrations concerned find this necessary, and that such

further allotment or assignment must not conflict with the frequency allotment plan established by the Conference for other parts of the world, particularly areas adjacent to the countries or regions concerned;

c) for the aeronautical mobile OR service, taking into account wave propagation conditions and the maximum possibility of frequency repetition to allot frequencies to countries in order to satisfy their requirements, bearing in mind that further assignment of frequencies within the areas specified will be done by Administrations.

The Conference successfully terminated its work with regard to establishing a plan for the allotment of frequencies for the aeronautical mobile OR service. This plan appears in a separate volume entitled "Volume II - Final Report of the International Administrative Aeronautical Radio Conference on the Plan for the Allotment of Frequencies for the Aeronautical Mobile OR Service Adopted at its First Session, Geneva, 1948".

The Conference also completed its studies and formulated recommendations on items J, K, L, and M of its agenda. These recommendations, along with certain other recommendations on collateral questions on which final action was taken, are contained in a separate volume entitled "Volume IV - Recommendations and Resolutions Adopted by the International Administrative Aeronautical Radio Conference (First Session) Geneva, 1948".

The texts and charts contained in this Volume entitled "Chapter I - Technical and Operational Principles Utilized for the Establishment of the Plan for the Allotment of Frequencies for the Aeronautical OR Service and of the Draft Plan for the Allotment of Frequencies for the Aeronautical Mobile R Service" and "Annex I - Minimum and Maximum Range Charts for Use as a Guide to the Allotment of Frequencies" were drawn up and adopted by the Conference. The texts were prepared on "yellow" paper with the intention that they would, together with the charts, form part of the Final Report of the Conference. The Conference having decided not to prepare a complete Final Report as yet, this material may be utilized for the purposes of the complete Final Report when prepared.

With regard to establishing a plan for the allotment of frequencies for the aeronautical mobile R service, the Conference drew up a draft plan but found that it could not, without further studies, establish a final plan acceptable to all Members of the Union, and therefore decided to suspend temporarily its work on the plan.

The Conference consequently made no final decision with regard to all of the documents relating to the establishment of a plan for the allotment of frequencies in the bands allocated to the aeronautical mobile R service, but decided to send to Administrations and interested international organizations the documents of the Conference which set forth the provisional results of the First Session with regard to the plan. These documents appear in Volume III, and their original texts are to be considered as reference texts.

The reasons for the temporary suspension of the work of the Conference are explained in detail in the first Resolution which appears at the beginning of Volume III. The action to be taken during the recess is explained in detail in the two Resolutions appearing in that Volume.

The draft plan for the allotment of frequencies to the aeronautical mobile R service, covering Major World Air Route Areas * and Regional and Domestic Air Route Areas, was drawn up by the Conference, utilizing the technical and operational principles set forth in this Volume. The draft plan resulted in such a shortage of allotment in certain regional and domestic sub-areas as compared with the stated requirements that it was obvious that the basic principles on which the plan was based, or alternatively the stated requirements, or both, would have to be modified in order to close the gap between requirements and allotments.

While a fairly large body of opinion considered that the draft plan had failed and that the basic principles should be revised, it was the majority view that the basic principles should not be degraded but that strenuous attempts should be made to reduce the stated requirements, which were considered, according to many opinions, to be far above the real needs, particularly if Administrations of adjacent areas or sub-areas would take action to coordinate their requirements.

If the basic principles were not altered, it was considered that a further long study by the Conference would not result in a sufficiently increased number of frequencies for allotment to sub-areas to satisfy the stated requirements.

It was therefore agreed by majority vote that the Conference should be adjourned to enable Administrations to study the draft plan and all other proposals dealing with the preparation of a plan, or devise other draft plans, and, more important, to coordinate their requirements with adjoining Administrations. This could be done either at special informal meetings, or at Conferences already scheduled or to be scheduled, in order to achieve the greatest possible frequency economy by joint use of sub-area or area frequencies.

* See First Resolution appearing at the beginning of Volume III.

CHAPTER I

Technical and Operational Principles Utilized for the Establishment of the Plan for the Allotment of Frequencies for the Aeronautical Mobile OR Service and of the Draft Plan for the Allotment of Frequencies for the Aeronautical Mobile R Service

Section I - Determination of Channels

1. Channel Separation

(1) Considering:

a) that the aviation service is growing rapidly and that the portion of the spectrum allocated to the aeronautical mobile service is extremely limited;

b) that the present trend towards higher aircraft speeds will require increasing speed in the handling of air ground messages;

c) that provision for the use of equipment with low stability in the aviation service would require wide communication channels;

d) that, however, the period which will elapse until the implementation of the plan established by the Conference will permit the modification or, if necessary, the retirement of equipment with low stability,

frequency separations adequate to permit high capacity means of communication as indicated in the following table were adopted:

Bands	
2850 - 3155 kc/s	7.0 kc/s
3400 - 4750 kc/s	7.0 kc/s
5480 - 6765 kc/s	7.5 kc/s
8815 - 9040 kc/s	8.5 kc/s
10005 - 10100 kc/s	9.0 kc/s
11175 - 11400 kc/s	9.5 kc/s
13200 - 18030 kc/s	10.0 kc/s
21850 - 23350 kc/s	12.0 kc/s

(2) The use of channels as derived from the above table, for the various classes of emissions, i.e., A1, A3, A4 etc... will be subject to special arrangements by the administrations concerned in order to avoid the interference which may result from the simultaneous use of the same channel for several classes of emission, no inherent priority being given to any particular class of emission.

(3) It is recognized that as a practical matter it might be possible for two or more A1 channels to be derived from each of the channels provided under this frequency separation plan and that there is a present requirement for manual telegraph communication in many parts of the world.

(4) The subdivision of channels and grouping of adjacent channels derived from the above table to permit the satisfaction of particular requirements, will be subject to special arrangements by the administrations concerned in order to avoid the interference which may result from the use of one or several channels for the different classes of emission.

(5) The arrangements in (2) and (4) above should be made under the provisions of Article 40 of the International Telecommunication Convention and Article 4 of the Radio Regulations, Atlantic City, 1947.

2. Frequencies to be Allotted

At the top and bottom of each column is shown, in percentage, the maximum deviation of the first and last frequency of each band which may be permitted in the direction of the band edge, assuming double side band modulation with a maximum modulation frequency of 3000 cycles.

Band: 2850 - 3155 kc/s		3400 - 3500 kc/s		3900 - 3950 kc/s		4650 - 4750 kc/s	
(0.035%)		(0.044%)		(0.025%)		(0.032%)	
2854		3404.5		3904		4654.5	
2861		3411.5		3911		4661.5	
2868		3418.5		3918		4668.5	R
2875		3425.5		3925	OR	4675.5	(7)
2882		3432.5		3932	(7)	4682.5	
2889		3439.5		3939		4689.5	
2896		3446.5		3946		4696.5	
2903		3453.5	R				
2910		3460.5	(14)	(0.025%)		4703.5	
2917		3467.5				4710.5	
2924		3474.5				4717.5	
2931		3481.5				4724.5	OR
2938	R	3488.5				4731.5	(7)
2945	(24)	3495.5				4738.5	
2952						4745.5	
2959		(0.043%)					
2966						(0.032%)	
2973							
2980							
2987							
2994							
3001							
3008							
3015							
3023.5	R + OR						
3032							
3039							
3046							
3053							
3060							
3067							
3074							
3081							
3088							
3095	OR						
3102	(18)						
3109							
3116							
3123							
3130							
3137							
3144							
3151							
(0.032%)							

Band: 5480-5730 kc/s		6525-6765 kc/s		8815-9040 kc/s		10005-10100 kc/s	
(0.018%)		(0.023%)		(0.022%)		(0.04%)	
5484		6529.5		8820		10012	
5491.5		6537		8828.5		10021	
5499		6544.5		8837		10030	
5506.5		6552		8845.5		10039	
5514		6559.5		8854		10048	R
5521.5		6567		8862.5		10057	(10)
5529		6574.5		8871		10066	
5536.5		6582		8879.5		10075	
5544		6589.5		8888		10084	
5551.5	R	6597	R	8896.5	R	10093	
5559	(26)	6604.5	(21)	8905	(18)		
5566.5		6612		8913.5		(0.04%)	
5574		6619.5		8922			
5581.5		6627		8930.5			
5589		6634.5		8939			
5596.5		6642		8947.5			
5604		6649.5		* 8956			
5611.5		6657		**8961.5			
5619		6664.5					
5626.5		6672		8967			
5634		6679.5		8975.5			
5641.5				8984			
5649		*6685		8992.5	OR		
5656.5		*6687.5		9001	(9)		
5664		6693		9009.5			
5671.5		6700.5		9018			
		6708		9026.5			
5680	R + OR	6715.5	OR	9035			
		6723	(12)				
5688		6730.5		(0.022%)			
5695.5		6738					
5703	OR	6745.5					
5710.5	(6)	6753					
5718		6760.5					
5725.5							
		(0.022%)					
(0.026%)							

* Available for A1 emission only

** It is necessary that equipment having a high degree of stability be used on this A1 channel only.

Band: 11175-11400 kc/s		13200-13360 kc/s		15010-15100 kc/s		17900-18030 kc/s	
(0.022%)		(0.019%)		(0.02%)		(0.01955%)	
11180.5		13205.5		15016		17906.5	
11190		13215.5		15026		17916.5	
11199.5		13225.5	OR	15036		17926.5	R
11209		13235.5	(6)	15046	OR	17936.5	(7)
11218.5	OR	13245.5		15056	(10)	17946.5	
11228	(11)	13255.5		15066		17956.5	
11237.5				15076		*** 17966.5	
11247		13264.5		15086			
11256.5		13274.5		* 15092.5		* 17975	
11266		13284.5		* 15096.5		*** 17983.5	OR
* 11273		13294.5	R			17993.5	(6)
		13304.5	(10)	(0.02%)		18003.5	
11280.5		13314.5				18013.5	
11290		13324.5				18023.5	
11299.5		13334.5					
11309		13344.4				(0.0194%)	
11318.5	R	13354.5					
11328	(13)						
11337.5		(0.0187%)					
11347							
11356.5							
11366							
11375.5							
11385							
11394.5							
(0.022%)							

* Available for A1 emission only

*** Although the separation between 17966.5 and 17975 kc/s and between 17975 and 17983.5 kc/s is smaller than the standard separation adopted for this band, the general decision regarding the use of the different classes of emission on high capacity channels is applicable to the channel centered at this frequency.

3. Adjacent Channels

In the interest of the suppression of adjacent channel interference, allotment plans should avoid the use of adjacent channels by aircraft operating in the same flight areas and by aeronautical stations serving those aircraft.

Section II - Technical Data

4. Standards for the Construction of Curves (See Annex I)

Considering that a need exists for some means of selecting the order of frequencies necessary for individual air route operation, minimum and maximum range charts have been prepared for use as a guide to the allotment of frequencies, in order to show the expected physical ranges. The maximum range charts were based on an assumed aircraft noise level of not more than 5 μv/m with a field intensity in the vicinity of the aircraft of 5 μv/m for hand-speed method of communications (A1 emission), and 20 μv/m for high capacity means of communication, including A3 emissions. It should be borne in mind that with adequate servicing the aircraft noise level can be limited to achieve the objective of 15 db signal to noise ratio for A3 emissions. It was decided not to make use of charts for 10 μv/m which had previously been prepared by the Preparatory Committee as a guide to the allotment of frequencies but, nevertheless, to include them for possible future use. The charts showing the curves and the explanation of their construction and manner of use appear as Annex I.

5. Repetition of Frequencies.

(1) For the purpose of considering the possibilities of repetition of frequencies it is assumed that aeronautical stations will have a radiated peak power of 4000 watts, that aircraft stations will have a radiated peak power of 200 watts and that a system of simplex communication will be employed. When using the curves in Annex I, in considering the possibilities of repetition of frequencies for all types of emission, except as set forth in (2) below, a figure of 30 db should be used initially and downgraded as far as 25 db in individual cases when this achieved an increase in the possibility of repetition. These figures apply to the reception conditions aboard an aircraft at the maximum service range when endeavouring to receive a particular ground station with interference from another ground station on the same frequency. In view of the disparity of power between the aircraft and ground stations, these figures will result in a protection ratio of the order of 17 and 12 db respectively at the ground station when receiving the aircraft through the interference of the other ground station.

(2) As a result of the use of the recommended system of channel separation, channels were produced at the junction of the R and OR bands, suitable for A1 emission only. For these channels a figure of 20 db should be used initially and downgraded as far as 15 db in individual cases when this achieved an increase in the possibility of repetition. In view of the disparity of power between the aircraft and ground station, these figures will result in a protection ratio of the order of 7 and 2 db respectively at the ground station when receiving the aircraft through the interference of the other ground station.

Section III - Communication Channel Capacity

6. Considering the requirement for the use of hand-speed telegraphy (A1) method of communication, the following figures were adopted as indicating the capacity of communication channels in terms of aircraft per hour and should be used to calculate the number of frequencies or families of frequencies required to be allotted to the Major World Air Route Areas:

- Per family of frequencies - 12 aircraft
- Per frequency (when a family consists of a single frequency) - 10 aircraft

In adopting those figures, it was taken into account that it will be necessary, in the regions in which meteorological conditions and density of air traffic make this necessary, to organize the broadcast of meteorological information destined to aircraft in flight on frequencies other than those used for routine air/ground communications. Otherwise, requests for special weather information by aircraft in flight may overload those frequencies.

ANNEX I

Minimum and Maximum Range Charts

for Use as a Guide to the Allotment of Frequencies

1. Introduction.

The range of distances over which skywave propagation of a given radio frequency will provide satisfactory communication is limited at the maximum range by attenuation of the signal and at the minimum range by the skip effect. The maximum range depends upon the type of service, the power of the transmitting station, the noise and interference levels at the receiving station and the required signal-to-noise and signal-to-interference ratios. The minimum range is independent of these factors. The solution to the problem which takes into account all the aforementioned variables has been undertaken by graphical means, as this appears to be the most useful and convenient form of presentation.

In the utilization of the charts in this document, it must, however, be borne in mind that (a) aircraft transmitters do not have the same power and usually have low power as compared with ground stations, and (b) noise levels in aircraft are generally high and difficult to limit to levels comparable with receiving set noise levels. Whereas the solutions resulting from the application of the charts are considered reasonable and usually coincident with practical experience, in some cases divergences will be found. In such a case, practical experience in the special situation involved should be used to arrive at the solution.

2. General description of the work undertaken.

The end result desired is a convenient collection of charts which will enable frequency families and geographical spacing of interference assignments to be determined to insure at least 90% reliable communications throughout the year and throughout the sunspot cycle. These charts appear and are indexed in this Annex.

The charts are based on two types of communications :

- A3 and other high capacity means of communication for which bandwidths are not greater than those required for A3.

- A1, Manual telegraphy

The graphs produced have been, as far as possible, placed in convenient form for the selection of frequencies in the R or OR frequency bands of the Radio Regulations, Atlantic City, 1947.

3. Assumptions and basic data utilized in the preparation of the graphs.

(1) Radiated Powers

For A1 emission the peak radiated power is assumed to be 1 kilowatt at the ground station and 50 watts at the aircraft.

For A3 emission the peak radiated power with 100% modulation is assumed to be 4 kW at the ground station and 200 watts at the aircraft. With 100% modulation the field intensity of the radiated wave is double that of the unmodulated wave. Thus the peak radiated power with 100% modulation is four times the radiated power of an unmodulated carrier wave.

(2) Bandwidths.

It is assumed that A3 modulation frequencies will be limited to 3 kc/s and that the sideband radiation of A1 emissions will not exceed that of A3 emissions. The use of a receiving set with good selectivity characteristics is assumed.

(3) Noise levels.

a) Local noise. The local noise on the aircraft is assumed to be 5 μv or less at the input terminals of the receiving set. It is expected that on new aircraft and on properly serviced used aircraft, the local noise level can be kept much lower than 5 μv.

Local noise at the ground station is assumed to be so low in comparison with local noise on the aircraft that it never imposes a limitation on communications.

b) Atmospheric noise. Atmospheric noise levels considered here are based upon data presented in the document listed as Reference 4. In that document atmospheric noise is classified as to noise grade and a series of charts for each grade is presented giving the field intensity necessary to provide 90% of the time 15 decibels signal-to-noise ratio for reception of A3 transmissions with a receiver having a bandwidth of 6 kc. Curves are included for winter, summer, and equinox seasons, at 4-hour intervals throughout the day beginning with 0000. The geographical distribution of noise grades at four seasons of the year is shown by maps, which are reproduced as Figs. 2-5. The lowest and highest grades shown by the maps are $1\frac{1}{2}$ and $4\frac{1}{2}$.

In Fig. 6 an idealized latitude distribution of atmospheric noise is shown. Fig. 6 C is an idealized distribution of noise grades based largely upon noise grades for continental masses. Noise grade $4\frac{1}{2}$ has been omitted as this occurs only in very small areas. Fig. 6 A shows required field intensities for A3 (15 decibels signal-to-noise ratio) at summer noon as a function of latitude based on Fig. 6 C and required field intensity charts of Reference 4. Fig. 6 B is a similar chart for night. These charts were utilized in the preparation of maximum range charts as explained hereinafter.

(4) Desirable signal-to-noise and signal-to-interference ratios.

For A3 communication a minimum of 15 decibels signal-to-noise or signal-to-interference ratio is considered desirable for good intelligibility. For A1 communication this ratio may be 0 decibels.

(5) Antennas.

a) The effective length of the aircraft receiving antenna is assumed to be one meter.

b) The effective length of the ground station receiving antenna is not specified, but is assumed to be great enough so that receiving set noise is never a controlling factor in the maximum range.

The use of directional antennas for receiving may improve both signal-to-atmospheric-noise and signal-to-interference ratios. Such antennas may be feasible in cases where the aircraft fly well-defined narrow routes.

Directional transmitting antennas at the ground station may also have the following advantages : the diminution of interference to stations lying in directions other than that of the principal lobes of the radiation pattern, and the reduction in the amount of power which must be delivered to the antenna to provide a satisfactory signal level at the aircraft. However, it should be remembered that use of a directional transmitting antenna without reduction of the power to the minimum required level may cause undue interference to other stations lying within the range of the principal lobes.

(6) Required field intensities.

a) Required field intensities for reception of A3 in the presence of atmospheric noise are those presented in Reference 4 and described above.

b) Required field intensities for reception of A1 in the presence of atmospheric noise are assumed to be 15 decibels less than for A3 emissions.

c) Since the aircraft local noise level is assumed to be 5 μv or less at the input terminals of the receiving set for an effective length of the antenna of one meter, the required field intensity for 15 decibels protection (for A3 emission) would be 28 μv/m.

However in view of the fact that lower local noise levels are attainable with proper servicing, charts in this Annex are based upon 20 μv/m required field intensity for A3 reception at the aircraft in the absence of atmospheric noise and interference.

d) The required field intensity for A1 reception on the aircraft, with an antenna having an effective length of one meter, is assumed to be 5 μv/m.

(7) Signal-to-interference (protection) ratios.

a) It was considered that duplication of A3 frequency assignments should be made on the basis of 30 decibels protection ratio at the aircraft for reception of the ground station through the interference of another ground station of equal power if the peak radiated power of the ground station is 4 kW and that of the aircraft is 200 watts. It was further considered that this figure might be downgraded as far as 25 decibels if additional assignments were thereby made possible.

Because the ratio of ground station power (4 kW) to aircraft power (200 watts) is 13 decibels, 30 and 25 decibel protection ratios at the aircraft imply that the protection ratios at the ground station for reception of the aircraft through the interference from another 4 kW ground station are only 17 and 12 decibels, respectively.

The protection ratios 17 and 12 decibels at the ground station will provide tolerable signal-to-interference ratios providing there are no uncorrelated variations (fading) in the field intensities of the desired and undesired signals. Actually, of course, some uncorrelated fading is inevitable. However, the effects of short term fading may be greatly minimized by the use of diversity antenna systems and by the diversity effect introduced by the motion of the aircraft.

b) Charts for selection of daytime frequencies are drawn for conditions at noon in summer, i.e., June in northern latitudes, December in southern latitudes, equinox at equatorial latitudes, at minimum sunspot number (0) and maximum sunspot number (125). Since minimum ranges (skip distances) at noon are usually greater in summer than in winter, and maximum ranges are shorter in summer, the interval between the minimum and maximum range is usually smaller at summer noon than at any other time of the year. Thus summer noon represents the worst condition encountered with respect to the number of frequencies required for communication.

(8) Propagation Characteristics.

All charts are based upon sky-wave propagation. Propagation characteristics are derived principally from references 2, 3, and 6.

4. Description of the Charts Produced.

(1) Minimum Range Charts for Noon.

Figures 7 through 18 show the minimum ranges for each frequency band as a function of latitude in the northern and southern hemisphere of each of the three zones W, I, and E of Fig. 1. The charts refer in each case to local noon at the midpoint of the great circle path between

the transmitting and receiving stations, to June in the northern hemisphere, and to December in the southern hemisphere. Separate charts are included for sunspot number 0 (sunspot minimum) and for sunspot number 125 (sunspot maximum).

On each curve, E- or F2-layer control of the range is indicated by a continuous or interrupted line, respectively. Effects of F1-layer are included with those of the E-layer. Because of its erratic and unpredictable effects, sporadic-E has not been considered. When it occurs, however, the effects are to decrease the minimum range.

The minimum ranges are based upon the E-layer muf (maximum usable frequency) and the F2-layer owf (optimum working frequency = 85% of the muf) and are thus nominally exceeded on only 10% of the days of the month. Values of the E-layer muf were obtained from Reference 2. Values of the F2-layer muf were obtained from Reference 3.

(2) Minimum Range Charts for Night. -

Minimum ranges for 2000, 0000, and 0400 hours are given in Figs. 19-21, 22-24, and 25-27 for the three zones W, I, and E, respectively. Except for the effects of sporadic-E, minimum ranges at night for frequencies of 3 Mc and above depend only upon the F2-layer. Since the primary purpose of the charts is to indicate the order of the lowest frequency required for a family, they are based upon the F2-layer minimum range (muf) at sunspot minimum in the month of December or June depending upon which is the greater minimum range, i.e., the greater skip distance.

(3) Maximum Range Charts for Noon.

Maximum ranges for radiotelephony, or other high capacity means of communication for which the required field intensities are the same as for radiotelephony, are given in Figs. 28 and 29 for noon at sunspot minimum and sunspot maximum, respectively. Corresponding charts for manual radiotelegraphy are given as Figs. 34 and 35. The assumption as to radiated power and required field intensities on which these charts are based have been stated.

As the charts indicate, at latitudes greater than a certain latitude which depends upon the frequency and type of emission (for example, approximately 40° in the case of radiotelephony at frequencies of 10 Mc and above) the ratio signal/atmospheric-noise at the ground station is greater than the ratio signal/local-noise at the aircraft. Therefore, above this latitude, the range is limited by the local noise at the aircraft. In such cases the range may be increased in practice by decreasing the local noise at the aircraft or by increasing the radiated power of the ground station. Below this latitude, where the range is

limited by atmospheric noise at the ground station, the range may be increased only by increasing the radiated power of the aircraft.

An idea of the dependence of the range of these factors may be obtained by comparing the charts for A3 and A1 at the same sunspot condition, for example Figs. 28 and 34, or Figs. 29 and 35. In the case of the higher latitudes where the ranges are limited by aircraft noise, the limiting field intensities are 20 μv/m (26 db above 1 μv/m) for A3, and 5 μv/m (14 db above 1 μv/m) for A1. The ratio of these field intensities is 12 decibels. Thus a decrease of 12 db in the noise level at the aircraft would result in ranges for A3 equal to those given for A1. The same increase in range would result from increasing the radiated power of the ground station by 12 db, that is, from 4 kW to 64 kW peak power in the case of A3, or from 1 kW to 16 kW peak power in the case of A1.

As a general rule, at latitudes where the range is limited by aircraft noise, the range increases by approximately 4% for each decibel increase in the radiated power of the ground station, or the range decreases by approximately 4% for each decibel decrease in the radiated power of the ground station, in the range of distances above about 300 km, and for frequencies below about 15 Mc/s.

(4) Maximum range charts for night.

a) Idealized latitude variation of maximum range.

In Fig. 30, the maximum range at night for radiotelephony in the various frequency bands is plotted as a function of latitude. These curves are based upon the required field intensity for night shown in Fig. 6. Interrupted (dashed) lines across the chart show ranges for ground station peak radiated powers of 200, 400, and 800 watts, as limited by local noise at the aircraft only. Above 800 watts this range is greater than 4000 km. As an example, consider the case of a ground station radiating 400 watts peak power. The range for this power, as limited by local noise at the aircraft only, is 1650 km. However, at 3 Mc, and at latitudes less than 65°, atmospheric noise at the ground station limits the range (curve labeled 3.0). As another example, at 6.6 Mc, when the peak radiated power of the ground station is 400 watts, atmospheric noise at the ground station limits the range at latitudes less than about 45°.

Fig. 36, similarly, gives maximum ranges at night as a function

of latitude for radiotelegraphy. In this case the range as limited by local aircraft noise for values of the peak radiated power of the ground station of 50 watts or more, is greater than 4000 km.

b) Maximum ranges for various noise grades.

Figs. 31-33 and 37-39 for A3 and A1, respectively, are maximum range charts for 2000, 0000, and 0400 hours in which curves of frequency vs range are plotted for various values of the atmospheric noise grade at the ground station. These charts are intended for use when a refinement of the ranges given by Figs. 30 and 36 is necessary. For this purpose the noise grade at the ground station is obtained from Fig. 2, 3, 4, or 5. In the case of stations north of 30° N and south of 30° S, curves for noise grades 3 and below apply only to the winter season, and are therefore to be used only with Fig. 2 in the case of stations north of 30° N, and only with Fig. 4 in the case of stations south of 30° S.

In Figs. 31-33 for A3, interrupted (dashed) lines drawn across the chart indicate the maximum range in the presence of aircraft noise only, for 200, 400, and 800 watts peak radiated power at the ground station.

In Figs. 37-39 for A1, maximum ranges, in the presence of aircraft noise only, are greater than 4000 km if the ground station peak radiated power is 50 watts or greater.

(5) Combined Maximum and Minimum Range Charts.

For convenience in the selection of orders of frequencies for noon conditions, minimum range charts (Figs. 7-18) and maximum range charts for A3 (Figs 28 and 29) have been combined in a series of charts, one for each 10° of latitude extending from 60° N to 40° S in each zone W, I, and E. On these charts the frequency has been plotted as a function of its minimum and maximum ranges for both sunspot minimum and sunspot maximum.

The curves are identified as follows : Narrow lines refer to minimum ranges; wide lines refer to maximum ranges; continuous lines refer to sunspot minimum; interrupted lines refer to sunspot maximum. The service range of a frequency at sunspot minimum is the interval between the narrow and wide continuous lines. The service range at sunspot maximum is the interval between the narrow and wide interrupted lines.

(6) Interference Range Charts.

a) Co-channel interference.

If two stations, desired and undesired, transmit on the same frequency, the interference caused by the undesired station to reception of the desired station at a given receiving station depends upon the ratio of the field intensities of the desired and undesired stations. This ratio, which is identical with the protection ratio in the case of co-channel interference, depends in turn upon the ratio of the radiated powers of the transmitting stations, and upon the attenuation experienced by each transmitted wave traversing the distance between its respective transmitting station and the receiving station. As the attenuation depends upon the distance, the ratio of field intensities at the receiving station is a function of the service range (the distance between the receiving station and the desired transmitting station) and the interference range (the distance between the receiving station and the undesired transmitting station).

At night when absorption is negligible, the attenuation is solely a function of the distance, but during daytime it depends also upon the geographical relation of the transmission path to the subsolar point. Thus, for example, the attenuation along a 2000 km path directed toward the subsolar point from a transmitter located 45° from the subsolar point, is greater than the attenuation along a path of the same length in a direction at right angles to the direction of the subsolar point. The attenuation along a path directed away from the subsolar point is even less and is in fact less than that along a path of the same length in any other direction.

This, together with the fact that the absorption along a given path in daylight is different for different frequencies, makes it impracticable to give a complete description of the interference possibilities on all frequencies.

Figs. 73-96 (reproduced from Reference 3) present information on the interference range as a function of service range and protection ratio in the form of a series of charts applying to 4, 6, 10, 15, 20, and 25 Mc, showing, for each frequency band, four typical relations of the transmission path to the subsolar point.

These typical relations are :

- The receiving station at the subsolar point receiving from transmitting stations in any direction.

- The receiving station 60° from the subsolar point receiving from transmitting stations in directions at right angles to the direction of the subsolar point.

- The receiving station 60° from the subsolar point receiving from transmitting stations in the direction opposite to that of the subsolar point.

- The receiving station located at the day-night line (90° from the subsolar point) receiving from transmitting stations in the same direction as the subsolar point.

Approximate solutions for other frequencies and relations of the transmission path to the subsolar point may be found by interpolation.

For transmission paths in darkness, because absorption is virtually absent, the attenuation is independent of frequency and of the direction of the transmitting station. Thus one chart, Fig. 97, is sufficient for night conditions.

b) Adjacent channel interference.

In addition to the factors mentioned above for co-channel interference, adjacent channel interference depends upon the frequency separation, the characteristics of the sidebands emitted by the interfering transmitter, and the selectivity characteristics of the receiving set.

In Fig. 98 the ratio of field intensities of the desired to undesired signals required for protection ratios of 25 and 30 decibels is plotted as a function of carrier frequency separation for the case of interference between two radiotelephone stations on adjacent channels. These curves are based upon data given in Reference 5 in which modulation frequencies up to 3 kc and a receiver with good selectivity characteristics are assumed. Corresponding curves for telegraphy interfering with telephony, telephony interfering with telegraphy, or telegraphy interfering with telegraphy, are nearly identical with those in the range of frequency separations shown, if the receiver selectivity characteristics are the same in each case.

Figs. 97 and 98 have been used to derive curves showing interference range as a function of service range and frequency separation. Inasmuch as the protection ratio scale of Fig. 97 refers to field intensity ratios, this scale may be converted into a frequency separation scale for a specified protection ratio through the relationship given in Fig. 98. The results for protection ratios of 25 and 30 decibels are shown in Figs. 99 and 100, respectively. Fig. 99 is used to find the separation necessary to provide 25 decibel protection between two transmitting stations operating on adjacent channels. Fig. 100 is used in the same way if 30 decibels is the required protection ratio.

Required geographical separations for daytime conditions may be obtained by using Fig. 98 together with the appropriate interference range charts, Figs. 73-96. Thus for 25 decibels protection, the field intensity ratio for the given frequency separation is read from curve A, Fig. 98. This field intensity ratio is then used as the protection ratio on the appropriate interference range chart to obtain the interference range.

Fig. 98 may also be used to obtain the field intensity ratio corresponding to any other desired protection ratio by adding the difference between this protection ratio and 25 decibels to the field intensity ratio obtained from curve A, Fig. 98. The resulting field intensity ratio may then be used as the protection ratio in Figs. 72-97 to obtain the interference range.

5. Procedure for selection of frequency families.

(1) General Procedure.

The combined minimum and maximum range charts, Figs. 40-72, provide a convenient and rapid means for the selection of frequencies for an individual route segment or route area, which, together with a frequency selected from the 3.0 or 3.5 Mc band, will constitute a family adequate to provide, in the absence of deleterious interference from other stations, at least 90% intelligible air-ground A3 communication at all times under normal radio propagation and reception conditions, except those in which the lowest frequency selected is not low enough. The applicability of the charts is, of course, subject to correspondence of radiated powers and required field intensities with the assumptions previously stated.

The process of selection is to determine from the curves a minimum set of frequencies necessary to cover the required distance at both sunspot minimum and sunspot maximum. For this purpose it is usually convenient to select families for sunspot minimum and sunspot maximum independently, and then to combine these into a single family suitable for sunspot minimum or sunspot maximum.

It is not advisable to select a family which fits between the minimum range curve for sunspot minimum and the maximum range curve for sunspot maximum. This results in an unnecessarily numerous family of frequencies.

Generally, the chart used is that corresponding to the latitude and zone of the midpoint of the great circle path between the ground stations at the terminals of a route segment. Actually the midpoint between the aircraft and the ground station moves as the aircraft moves, but it is usually sufficiently accurate to consider only the midpoint of the route segment or of the maximum anticipated distance

between the aircraft and the ground station in the case of a flight involving a single ground station.

In case one or both ground stations are located within approximately 40° of the equator, it may be preferable to use the chart corresponding to the latitude of the ground station nearer the equator. This is because, on the basis of Figs. 28 and 29, the maximum service range is limited by atmospheric noise at the ground station at latitudes less than about 40°.

If the midpoint latitude or the ground station latitude, whichever is used as the reference point, lies approximately half-way between two adjacent latitudes for which the charts are prepared, it is preferable, unless an interpolation is made, to use the chart for the lower latitude as this represents the more severe limitation on the maximum range.

Further, if the reference point lies on the boundary between two zones of Fig. 1 (e.g. I & E), the chart on which the minimum ranges are greater is used.

Maximum ranges corresponding more closely to the actual noise grade for the ground station, where this differs from that given by the idealized curve of Fig. 60, may be obtained as follows : Read the true noise grade at the ground station on Fig. 2, 3, 4, or 5, bearing in mind that the maximum range curves relate to summer conditions, i.e., June in northern latitudes, December in southern latitudes, and equinox in equatorial latitudes. Next, on Fig. 60 find the latitude corresponding to this noise grade on the side marked "summer". Then the combined minimum and maximum range chart for this latitude gives the correct maximum ranges.

In the case of north-south route segments, the midpoint latitude is equal to the arithmetic mean of endpoint latitudes. On an east-west route segment, however, this is no longer true except near the equator. For example, if the latitude of one station were 30° N and that of the other station were at 40° N but 20° west of the first station, the latitude of the midpoint would not be 35° N but somewhat higher.

If any pair of adjacent orders of frequencies selected on the basis of the chart bear a ratio to each other greater than about 2.1, it is desirable that an intermediate frequency be introduced in order to insure that the family will be adequate for conditions at times of the day other than noon. At such times, the values of the minimum and maximum ranges at each frequency will be altered and this may result in an appreciable interval of distance over which none of the frequencies is suitable if the intervals between successive frequencies are too great.

(2) Selection of noon frequencies - Example

As a specific example, consider an aircraft departing from New York (latitude 41° N, approximately) and flying south for a distance of 2500 km. The midpoint latitude for this distance is 29.5° N. Thus, as the midpoint is located in the W-zone near 30° N, the chart labelled W-zone, 30° N (Fig. 43) will be used.

The minimum and maximum ranges at sunspot minimum and maximum for the various frequencies as given by the chart for W-zone 30° N are listed in the following table:

Frequency	Service	Sunspot minimum		Sunspot maximum	
Mc/s		Min. range	Max. range	Min. range	Max. range
3.0	R, OR	0 km	100 km	0 km	0 km
3.5	R	0	250	0	0 km
4.0	OR	0	350	0	200
4.7	R, OR	0	550	0	300
5.6	R, OR	350	700	0	450
6.6	R, OR	450	950	0	600
9.0	R, OR	650	1500	450	1100
10.0	R	750	1700	550	1250
11.3	R, OR	950	2050	650	1550
13.3	R, OR	1300	2500	850	1900
15.0	OR	1600	2800	1050	2200
18.0	R, OR	skips	skips	1400	2600
22.6	R, OR	skips	skips	skips	skips

Thus to provide communication at sunspot minimum and maximum separately for the R service and the OR service, frequencies from the following orders might be selected:

R Service

Sunspot minimum	Sunspot maximum
4.7 Mc/s	6.6 Mc/s
6.6 Mc/s	10.0 Mc/s
10.0 Mc/s	13.3 Mc/s
13.3 Mc/s	18.0 Mc/s

OR Service

4.7 Mc/s	6.6 Mc/s
6.6 Mc/s	9.0 Mc/s
9.0 Mc/s	13.3 Mc/s
13.3 Mc/s	18.0 Mc/s

It will be observed that in the case of the R service, frequencies of 6.6, 10.0 and 13.3 Mc/s are common to the families for sunspot minimum and maximum. Thus these frequencies, plus 4.7 Mc/s for short ranges at sunspot minimum and 18.0 Mc/s for long ranges at sunspot maximum, will generally satisfy the requirement at summer noon throughout the sunspot cycle.

In the case of the OR service, 6.6, 9.0 and 13.3 Mc/s are common to the families for sunspot minimum and maximum. Again, addition of 4.7 and 18.0 Mc/s to these frequencies provides a family adequate at summer noon throughout the sunspot cycle.

(3) Completion of family for night

The above frequencies were selected for daytime communication only. If communication at night must also be provided for, a frequency at 3.0 or 3.5 Mc/s will usually be necessary for short ranges.

Reference to Figs. 19-21, the nighttime minimum range charts for the W-zone, will indicate the following minimum ranges for 3.5 and 3.0 Mc/s at 2000, 0000 and 0400 hours at 30° N:

	2000 hr	0000 hr	0400 hr
3.5 Mc/s	0 km	500 km	0 km
3.0 Mc/s	0 km	0 km	0 km

Thus it appears that 3.0 Mc/s is well suited as a short range night frequency, and, except for a few winter months at sunspot minimum, 3.5 is also suitable.

In selecting this frequency it should be remembered that a portion of the distance nearest the transmitting station will be covered by the ground wave in case the sky wave skips at short range.

(4) Frequency Spacing

Examination of the families selected in the above example shows that in no case does the ratio of adjacent frequencies exceed 2:1. Thus it is unnecessary to introduce an additional frequency to insure adequate coverage at all times.

6. Frequency Sharing - Determination of Geographical Separation

(1) Co-channel assignments

Interference ranges for daytime conditions may be determined from Figs. 73-96. Interference ranges for night conditions aregiven by

Fig. 97. These charts have been described.

Because of relatively less attenuation at night, interference ranges at night are greater than in daytime. Therefore, if the geographical separation of stations to which the same or adjacent channels are assigned is based upon the night-time interference range, the use of the frequency will also be adequately protected for daytime. However, separations based on daytime protection will not usually provide night-time protection.

The service range on which the interference range and geographical separation are to be based may be specified arbitrarily or selected on the basis of one of the maximum range charts. As an example, consider the night-time range for 3.0 Mc/s at 40° latitude given in Fig. 30. Assuming the peak radiated power of the ground station is more than 200 watts, the range is approximately 500 km. If the desired protection ratio at the aircraft is 30 decibels, and the radiated power of the undesired station is the same as that of the desired ground station, the interference range of the undesired station is read at 30 decibels protection ratio on the curve for 500 km service range, Fig. 97. The interference range in this case is a little greater than 10 000 km. For a desired protection ratio of 25 decibels, the interference range is 8000 km.

In case the radiated power of the undesired station is not the same as that of the desired station, the interference range should be read at a value of the protection ratio equal to the desired protection plus the ratio of the radiated powers of the undesired and desired stations expressed in decibels. If a directive antenna is used at either or both transmitting stations, the radiated power in each case should be the total radiated power multiplied by the gain of the antenna (as defined in paragraph 65 of the Radio Regulations, Atlantic City) taken in the direction of the receiving station. Further, if a directional receiving antenna is used at the receiving station, the radiated power ratio should also be multiplied by the ratio of the receiving antenna gain in the direction of the undesired station to that in the direction of the desired station.

At night the maximum service range is always limited by atmospheric noise except in the case of radiotelephone at high latitudes when the radiated power of the ground station is low (see Fig. 30). Also the range increases rapidly with increasing latitude. Thus on the basis of the service ranges in Fig. 30 of two stations operating on the same channel or on adjacent channels, the interference range, and therefore the geographical separation, is controlled by the station at the high latitude.

Similar considerations apply to daytime interference, but under conditions where the service range is limited by aircraft noise, for example

above 40° latitude in Figs. 28 and 29, the variation of service range with latitude is not as great as when it is limited by atmospheric noise. The interference range in such cases is therefore less critically dependent upon the latitude of the stations.

(2) Adjacent-channel assignments

Determination of the interference range for a given frequency separation and for 25 and 30 decibels desired protection ratios under night conditions may be made from Figs. 99 and 100, described previously. The use of Fig. 98 to determine interference ranges for daytime conditions and for other desired protection ratios was also described.

All of the considerations mentioned above, involving the effect of varying service range and radiated power also apply in the case of adjacent-channel interference ranges.

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2. Ionospheric Data, IRPL-F18, February 1946.

3. High Frequency Radio Propagation Charts for Sunspot Minimum and Sunspot Maximum, CRPL-1-2, 3-1, December 23, 1947.

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5. Separations between Frequency Assignments for Radio Services on Adjacent Channels - Report of Committee "A", U.S. Preparatory Team, Provisional Frequency Board, January 1948.

6. Calculation of Sky-wave Field Intensities, Maximum Usable Frequencies, and Lowest Useful High Frequencies - U.S. Signal Corps, Radio Propagation Unit, Technical Report No. 6 (Second printing), October 1947.

References 1, 4 and 6 are available on request directed to the Office of Technical Services, Department of Commerce, Washington 25, D. C.

References 2, 3 and 5 are not available for general distribution.

INDEX

(Beginning with Figure 2 the title for each chart, with the exception of Figures 41 through 72, appears on the page opposite the figure. The titles for Figures 41 through 72 are the same as that for Figure 40.)

13. Minimum Ranges, Noon, Dec., W-zone, Southern Hemisphere, SS 0
14. " " " " " " " " " 125
15. " " " June E " Northern " " 0
16. " " " " " " " " " 125
17. " " " Dec. " " Southern " " 0
18. " " " " " " " " " 125

Minimum Ranges, 2000, 0000, 0400

19. Minimum Ranges, 2000, 0000, 0400, W-zone, SS 0
20. " " " " " " " " "
21. " " " " " " " " "
22. " " " " " I " " "
23. " " " " " " " " "
24. " " " " " " " " "
25. " " " " " E " " "
26. " " " " " " " " "
27. " " " " " " " " "

Maximum Ranges

28. Maximum Ranges, Noon, A3, Latitude Variation, SS 0
29. " " " " " " " 125
30. " " Night " " " ------
31. " " A3, 2000, 0000, 0400, Various Noise Grades
32. " " " " " " " " "
33. " " " " " " " " "
34. " " A1, Noon, Latitude Variation, SS 0
35. " " " " " " " 125

36. Maximum Ranges, A1, Night, Latitude Variation,

37. " " " 2000, 0000, 0400, Various Noise Grades

38. " " " " " " " " "

39. " " " " " " " " "

Combined Minimum and Maximum Ranges.

40 - 50 Combined Minimum and Maximum Ranges, A3, Noon, W-Zone, for Latitudes 60° N - 40° S

51 - 61 Combined Minimum and Maximum Ranges, A3, Noon, I-Zone, for Latitudes 60° N - 40° S

62 - 72 Combined Minimum and Maximum Ranges, A3, Noon, E-Zone, for Latitudes 60° N - 40° S

Interference Ranges.

73. Interference Ranges, 4 Mc/s, Receiver at Subsolar Point (1)

74. " " " " " 60° from Subsolar Point Reception Parallel to Day-Night line (2)

75. " " " " Receiver 60° from Subsolar Point, Reception from Direction of d-n line (3)

76. " " " " Receiver at d-n line, Reception from Direction of Subsolar Point (4)

77 - 80 " " 6 Mc/s, (1), (2), (3), and (4).

81 - 84 " " 10 Mc/s, " " " "

85 - 88 " " 15 Mc/s " " " "

89 - 92 " " 20 Mc/s " " " "

93 - 96 " " 25 Mc/s " " " "

97. " " All frequencies. Night Conditions (no absorption)

98. Relative field intensity of adjacent channel carriers as a function of frequency separation for 25 and 30 db protection ratios, A3.

99. Interference range as a function of frequency separation, night conditions, A3, 25 db protection.

100. Interference range as a function of frequency separation, night conditions, A3, 30 db protection.

CONFÉRENCE INTERNATIONALE ADMINISTRATIVE
DES RADIOCOMMUNICATIONS AÉRONAUTIQUES
GENÈVE, 1948

Annexe I

GRAPHIQUES DES PORTÉES MINIMUM ET MAXIMUM, A UTILISER COMME GUIDE POUR L'ATTRIBUTION DES FRÉQUENCES

INTERNATIONAL ADMINISTRATIVE
AERONAUTICAL RADIO CONFERENCE
GENEVA, 1948

Annex I

MINIMUM AND MAXIMUM RANGE CHARTS FOR USE AS A GUIDE TO THE ALLOTMENT OF FREQUENCIES

CONFERENCIA ADMINISTRATIVA INTERNACIONAL
DE RADIOCOMUNICACIONES AERONÁUTICAS
GINEBRA, 1948

Anexo I

GRÁFICOS DE ALCANCE MÁXIMO Y MÍNIMO QUE SIRVEN DE GUÍA PARA LA ASIGNACIÓN DE FRECUENCIAS

Международная Административная
Авиационная Радиоконференция
ЖЕНЕВА, 1948

Приложение I

ГРАФИКИ МАКСИМАЛЬНОЙ И МИНИМАЛЬНОЙ ДАЛЬНОСТИ ДЛЯ РУКОВОДСТВА ПРИ ВЫДЕЛЕНИИ ЧАСТОТ

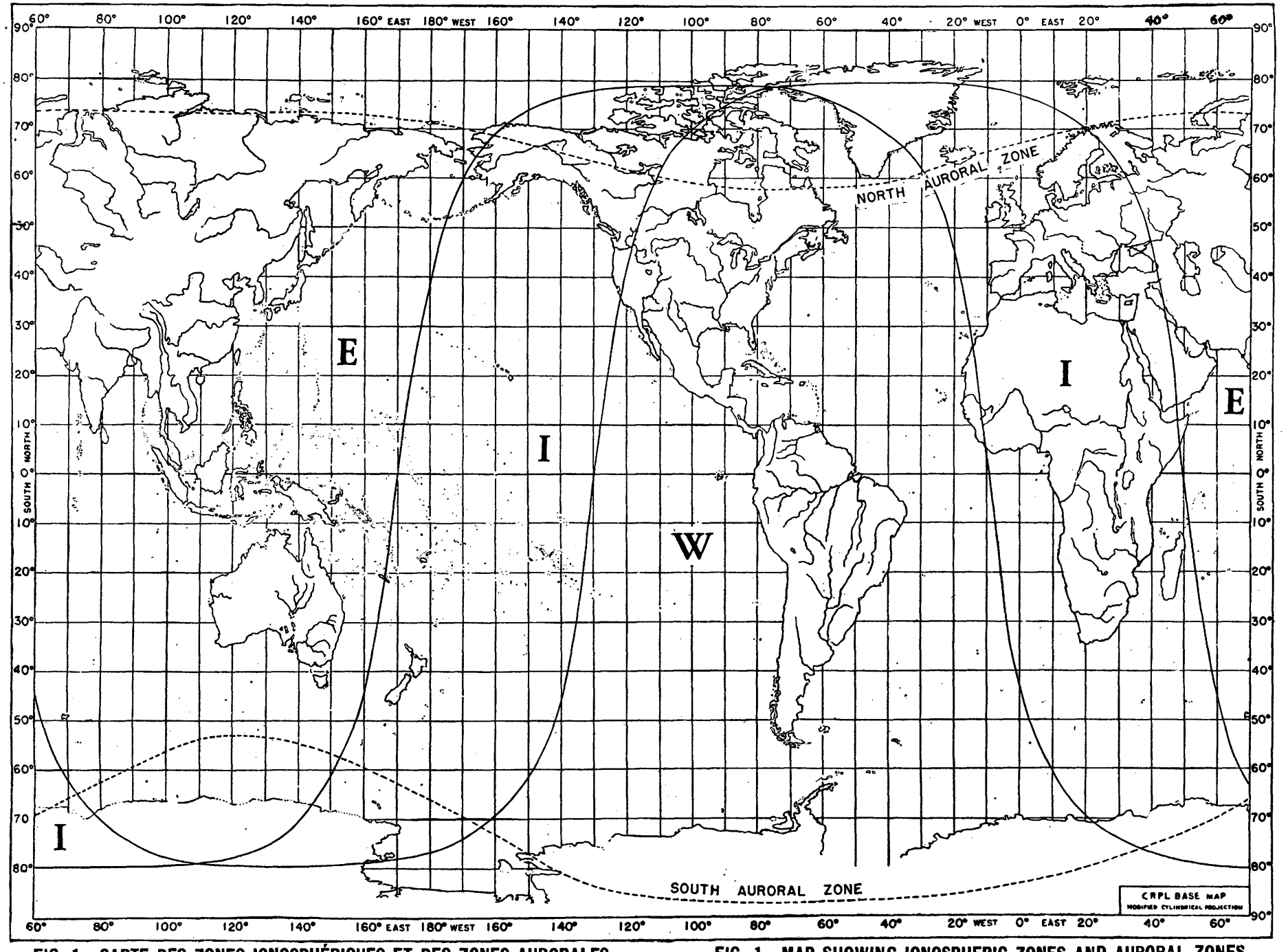


FIG. 1. CARTE DES ZONES IONOSPHÉRIQUES ET DES ZONES AURORALES.

FIG. 1. MAPA DE LAS ZONAS IONOSFÉRICAS Y DE LAS ZONAS AURORALES.

FIG. 1. MAP SHOWING IONOSPHERIC ZONES AND AURORAL ZONES.

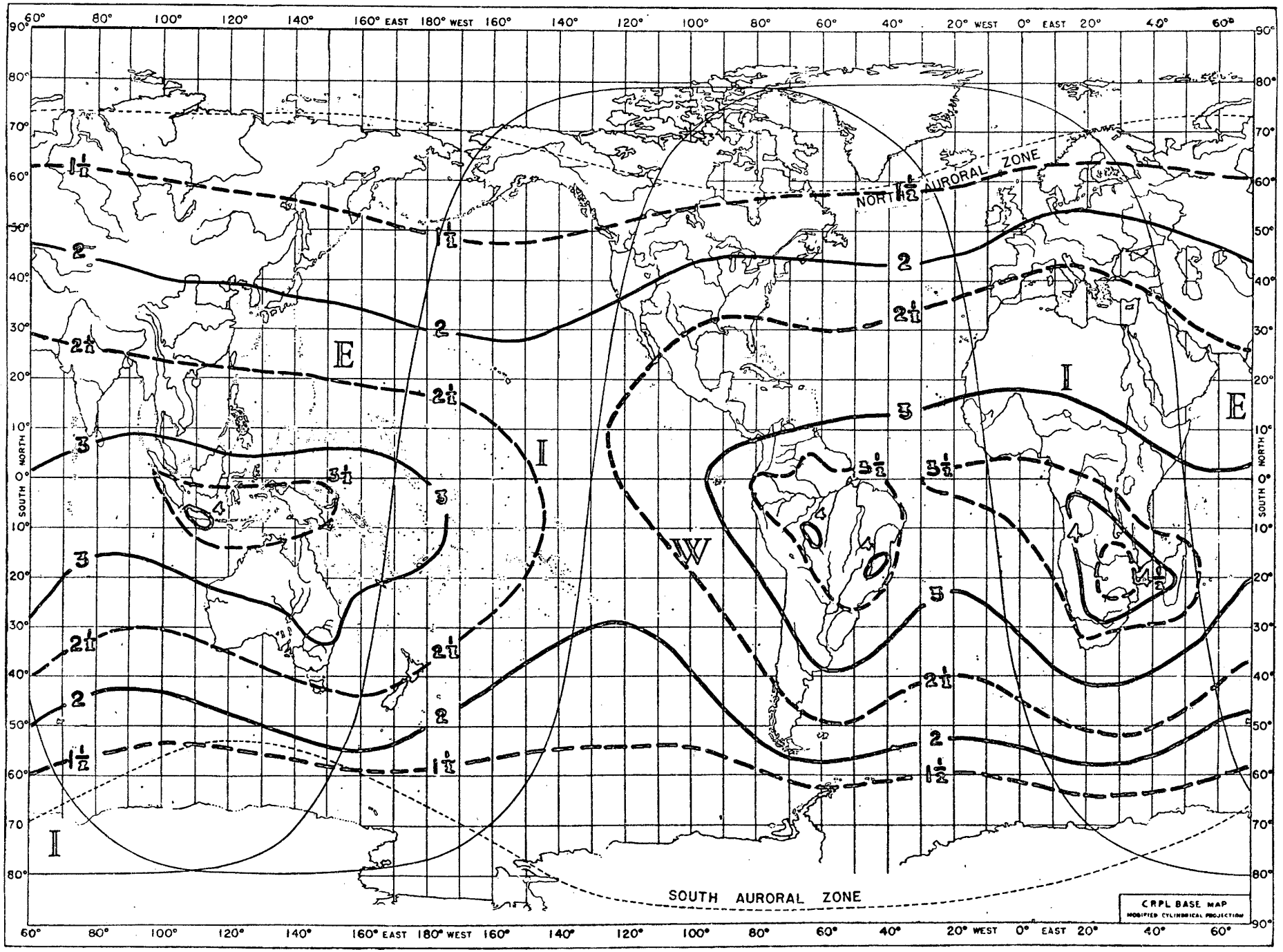
РИС. 1. КАРТА ИОНОСФЕРНЫХ И ПОЛЯРНЫХ ЗОН.

Fig. 2. Répartition des degrés d'intensité des parasites atmosphériques pour la période décembre - janvier - février.

Fig. 2. Noise grade distribution for period December - January - February.

Fig. 2. Distribución de los grados de intensidad de los rùidos para el período de diciembre - enero - febrero.

Рис. 2. Распределение поясов атмосферных помех на период декабрь - январь - февраль.


NORTH AURORAL ZONE
SOUTH AURORAL ZONE
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SOUTH NORTH
SOUTH NORTH
CRPL BASE MAP
MODIFIED CYLINDRICAL PROJECTION

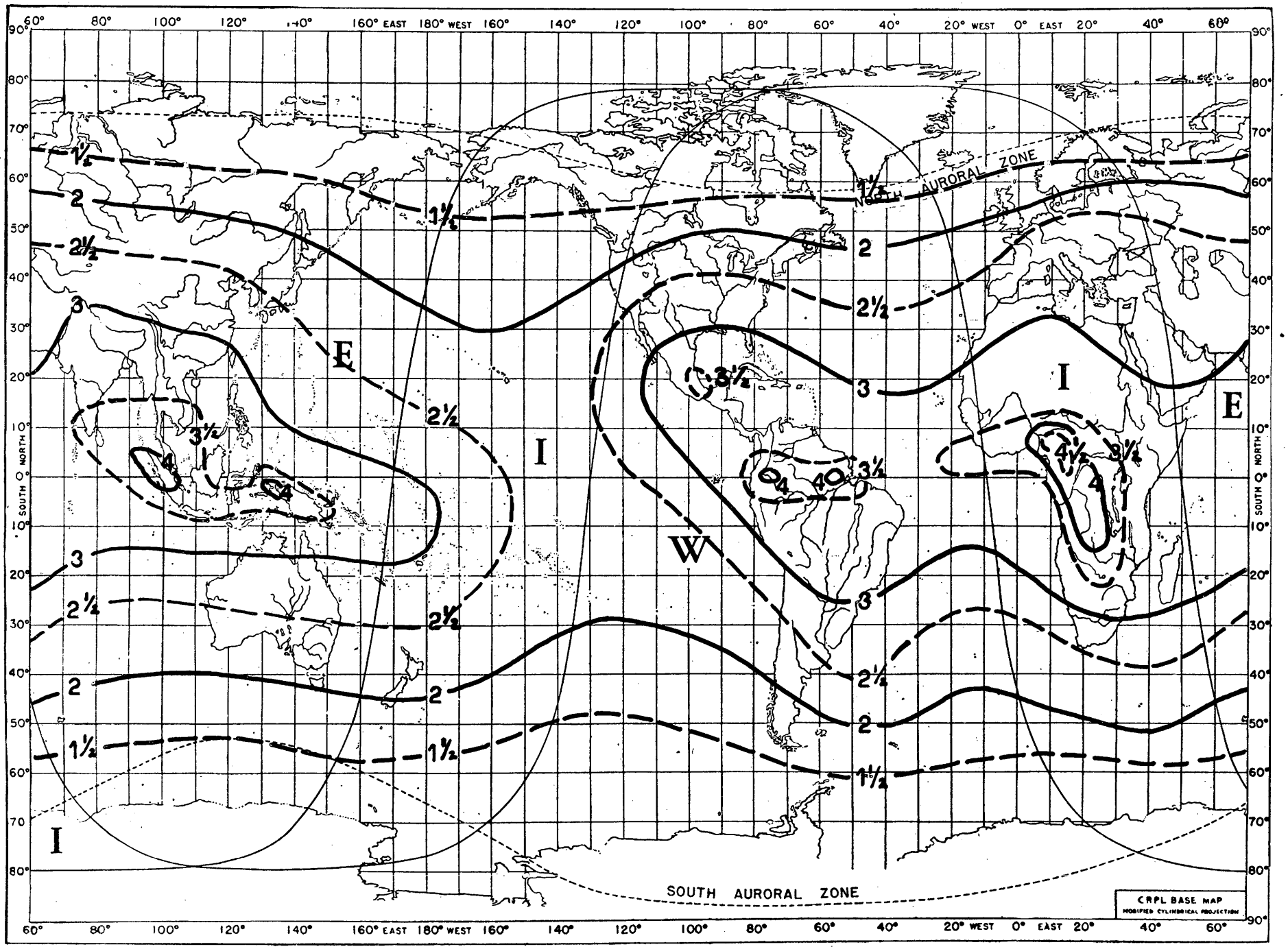
FIG.2 РИС.2

Fig. 3. Répartition des degrés d'intensité des parasites atmosphériques pour la période mars - avril - mai.

Fig. 3. Noise grade distribution for period March - April - May.

Fig. 3. Distribución de los grados de intensidad de los ruidos para el período de marzo - abril - mayo.

Рис. 3. Распределение поясов атмосферных помех на период март - апрель - май.


60° 80° 100° 120° 140° 160° EAST 180° WEST 160° 140° 120° 100° 80° 60° 40° 20° WEST 0° EAST 20° 40° 60°
90° 80° 70° 60° 50° 40° 30° 20° 10° SOUTH 0° NORTH 10° 20° 30° 40° 50° 60° 70° 80° 90°
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2
2½
3
3½
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I
W
NORTH AURORAL ZONE
SOUTH AURORAL ZONE
CRPL BASE MAP
MODIFIED CYLINDRICAL PROJECTION

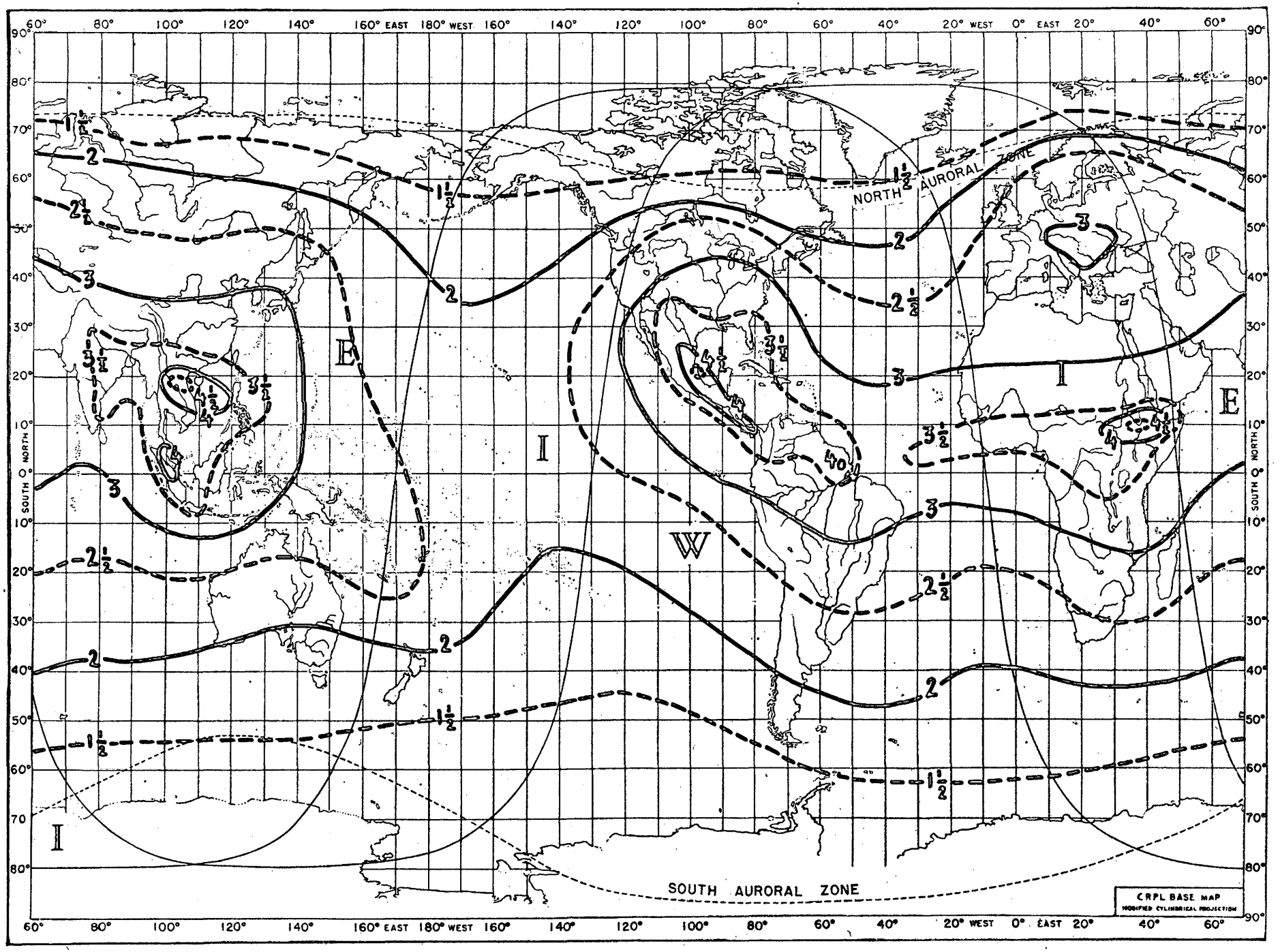
FIG.3. РИС.3.

Fig. 4. Répartition des degrés d'intensité des parasites atmosphériques pour la période juin - juillet - août.

Fig. 4. Noise grade distribution for period June - July - August.

Fig. 4. Distribución de los grados de intensidad de los ruidos para el período de junio - julio - agosto.

Рис. 4. Распределение поясов атмосферных помех на период июнь - июль - август.


NORTH AURORAL ZONE
SOUTH AURORAL ZONE
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W
I
I
E
CRPL BASE MAP
MODIFIED CYLINDRICAL PROJECTION
SOUTH NORTH
60° 80° 100° 120° 140° 160° EAST 180° WEST 160° 140° 120° 100° 80° 60° 40° 20° WEST 0° EAST 20° 40° 60°

FIG. 4. РИС. 4.

Fig. 5. Répartition des degrés d'intensité des parasites atmosphériques pour la période septembre - octobre - novembre.

Fig. 5. Noise grade distribution for period September - October - November.

Fig. 5. Distribución de los grados de intensidad de los ruidos para el período de septiembre - octubre - noviembre.

Рис. 5. Распределение поясов атмосферных помех на период сентябрь - октябрь - ноябрь.

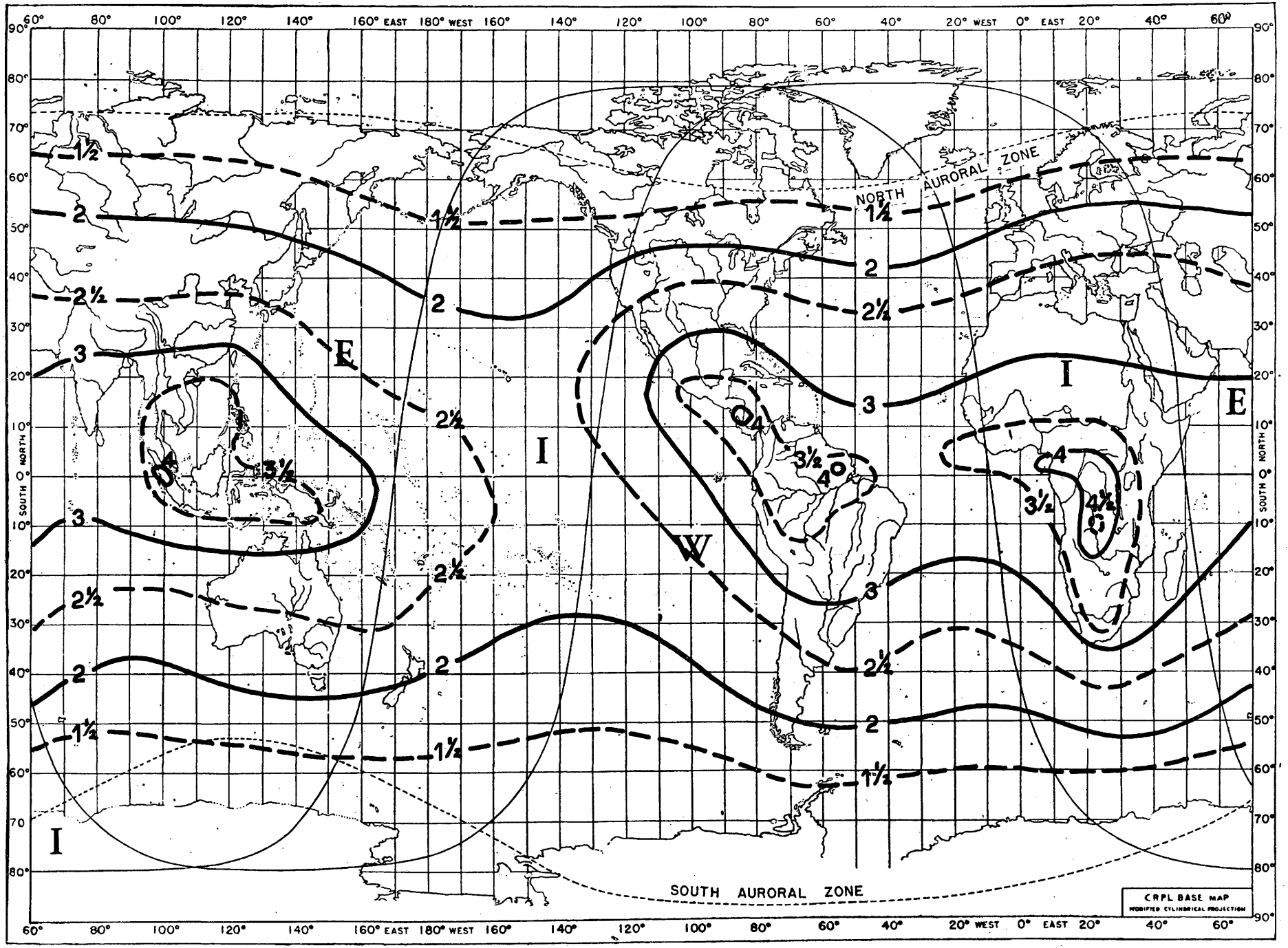

NORTH AURORAL ZONE
SOUTH AURORAL ZONE
CRPL BASE MAP
MODIFIED CYLINDRICAL PROJECTION
160° EAST 180° WEST 160°
20° WEST 0° EAST 20°
SOUTH NORTH
F
I
W
E
O

FIG. 5. РИС. 5.

Fig. 6 (a) Intensité du champ nécessaire pour la radiotéléphonie en présence des parasites atmosphériques, à midi, au mois de juin pour l'hémisphère nord et au mois de décembre pour l'hémisphère sud.

(b) Intensité du champ nécessaire pour la radiotéléphonie en présence des parasites atmosphériques, la nuit.

(c) Variations théoriques du degré d'intensité des parasites atmosphériques en fonction de la latitude.

Les chiffres figurant sur les courbes indiquent des Mc/s.

Fig. 6 (a) Required field intensity for radiotelephone in the presence of atmospheric noise, noon, June in northern hemisphere, December in southern hemisphere.

(b) Required field intensity for radiotelephone in the presence of atmospheric noise, night.

(c) Idealized latitude distribution of atmospheric noise grades.

Figures on curves are Mc/s.

Fig. 6 (a) Intensidad de campo requerida para radiotelefonía en presencia de ruido atmosférico; mediodía de junio en el hemisferio norte, diciembre en el hemisferio sur.

(b) Intensidad de campo requerida para radiotelefonía en presencia de ruido atmosférico, noche.

(c) Distribución teórica de los grados de intensidad del ruido atmosférico en función de la latitud

Рис. 6. (а) Напряженность поля, требуемая для радиотелефонии, при наличии атмосферных помех, полдень, июнь в северном полушарии, декабрь в южном полушарии. Цифры на кривых обозначают частоту в мгц.

(b) Напряженность поля, требуемая для радиотелефонии, при наличии атмосферных помех, ночью.

(c) Идеализированное распределение поясов атмосферных помех по широтам.

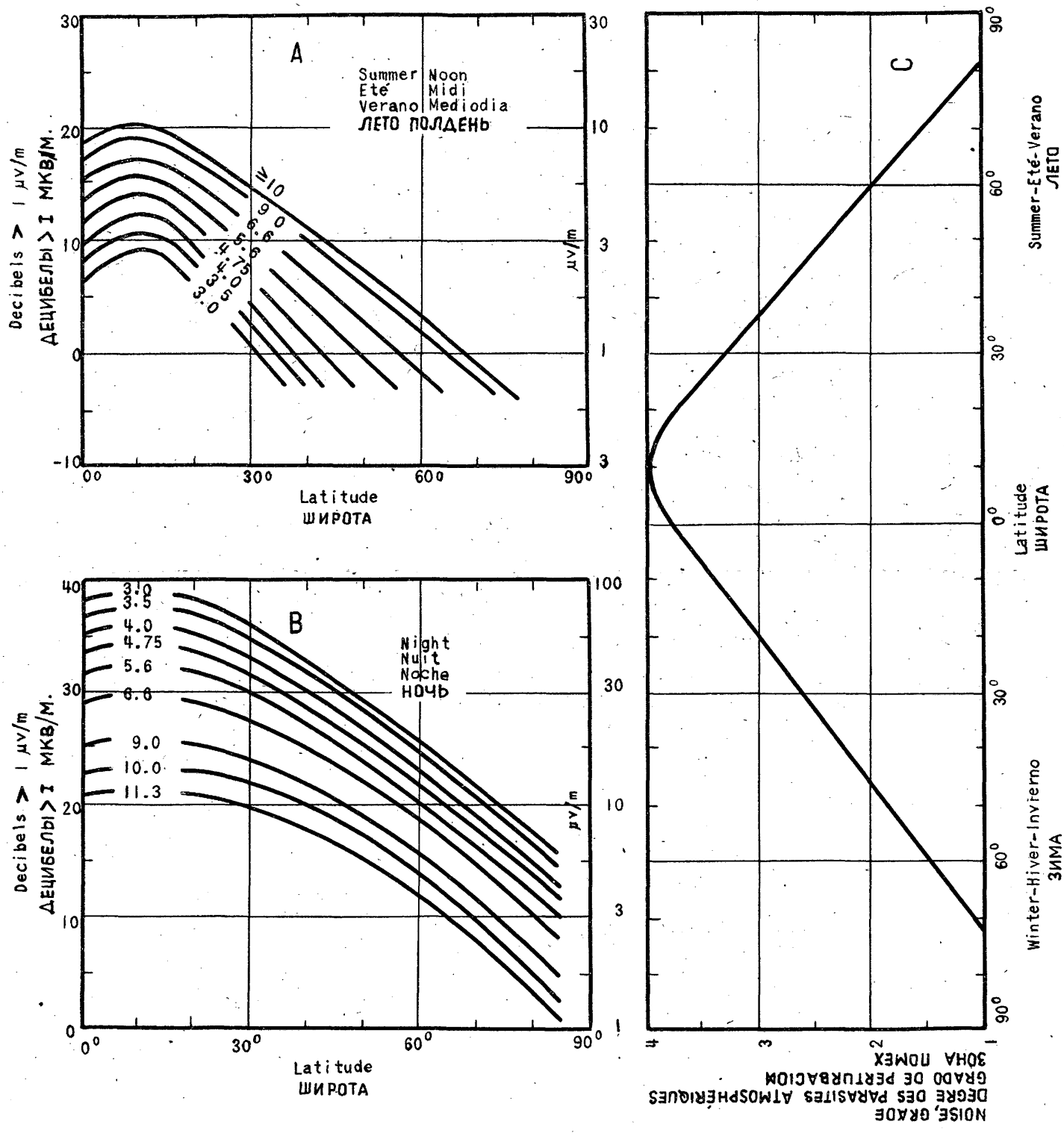

A
Summer Noon
Eté Midi
Verano Mediodia
ЛЕТО ПОЛДЕНЬ
Decibels > 1 μv/m
ДЕЦИБЕЛЫ > 1 МКВ/М.
μv/m
Latitude
ШИРОТА
B
Night
Nuit
Noche
НОЧЬ
3.0
3.5
4.0
4.75
5.6
6.6
9.0
10.0
11.3
C
Summer-Été-Verano
ЛЕТО
Winter-Hiver-Invierno
ЗИМА
NOISE, GRADE
DEGRE DES PARASITES ATMOSPHERIQUES
GRADO DE PERTURBACION
ЗОНА ПОМЕХ

Fig.6 Рис.6

Fig. 7. Portées minimum à midi au mois de juin, zone W, hémisphère nord, 0 tache solaire.

Les chiffres figurant sur les courbes représentent des Mc/s.

————FMU couche E - - - -FOT couche F2

Fig. 7. Minimum distance range, noon, June, W-zone, northern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

————E-layer MUF - - - - F2-layer OWF

Fig. 7. Alcance mínimo, mediodía, junio, zona-W, hemisferio septentrional, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU Capa-E - - - - FOT capa F2

Рис. 7. Минимальная дальность действия, полдень, июнь, зона-W , северное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - Слой F2 ОРЧ

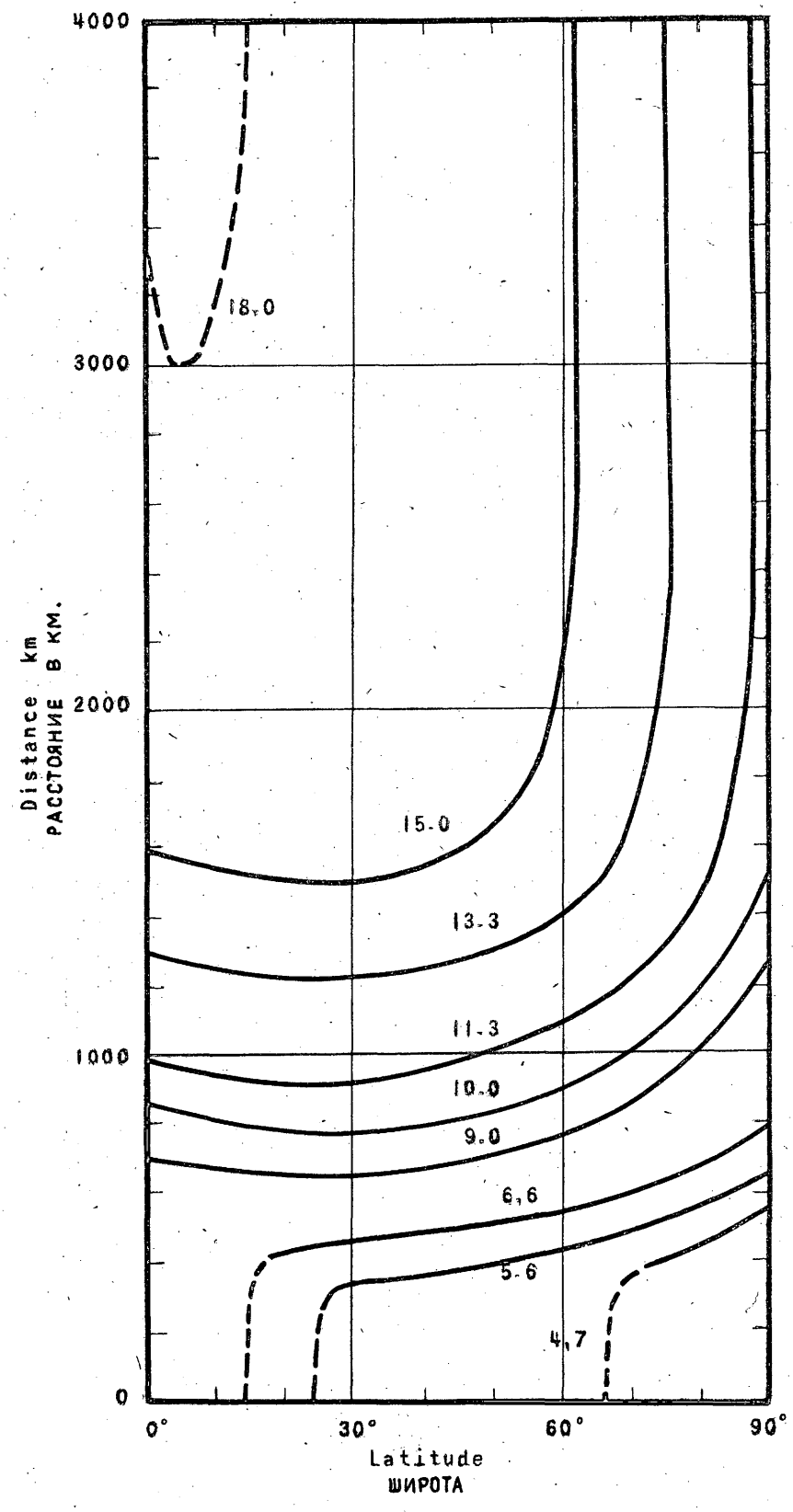

4000
3000
2000
1000
0
Distance km
РАССТОЯНИЕ В КМ.
18.0
15.0
13.3
11.3
10.0
9.0
6,6
5.6
4,7
0°
30°
60°
90°
Latitude
ШИРОТА

Fig.7 Рис.7

Fig. 8. Portées minimum à midi au mois de juin, zone W, hémisphère nord, 125 taches solaires.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 8. Minimum distance range, noon, June, W-zone, northern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 8. Alcance mínimo, mediodía, junio, zona-W, hemisferio septentrional, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa-E - - - - FOT capa F2

Рис. 8. Минимальная дальность действия, полдень, июнь, зона-W северное полушарие, число солнечных пятен 125. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - - Слой F2 ОРЧ

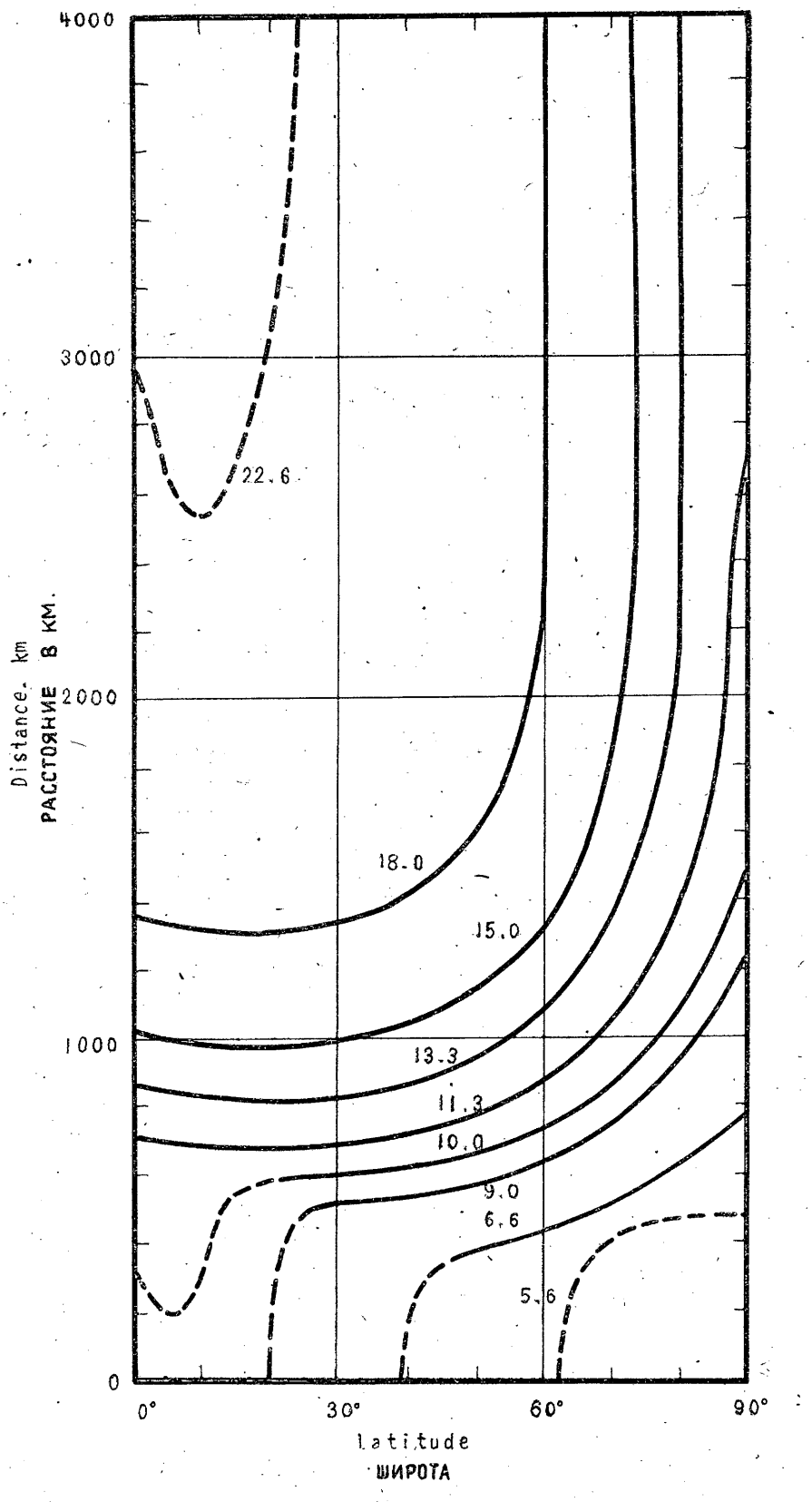

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
0°
30°
60°
90°
latitude
ШИРОТА

Fig.8 Рис.8

Fig. 9. Portées minimum à midi au mois de décembre, zone W, hémisphère sud, 0 tache solaire.

Les chiffres fugurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 9. Minimum distance range, noon, December, W-zone, southern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 9. Alcance mínimo, mediodía, diciembre, zona-W, hemisferio austral, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис. 9. Минимальная дальность действия, полдень декабрь, зона-W, южное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - - Слой F_2 ОРЧ

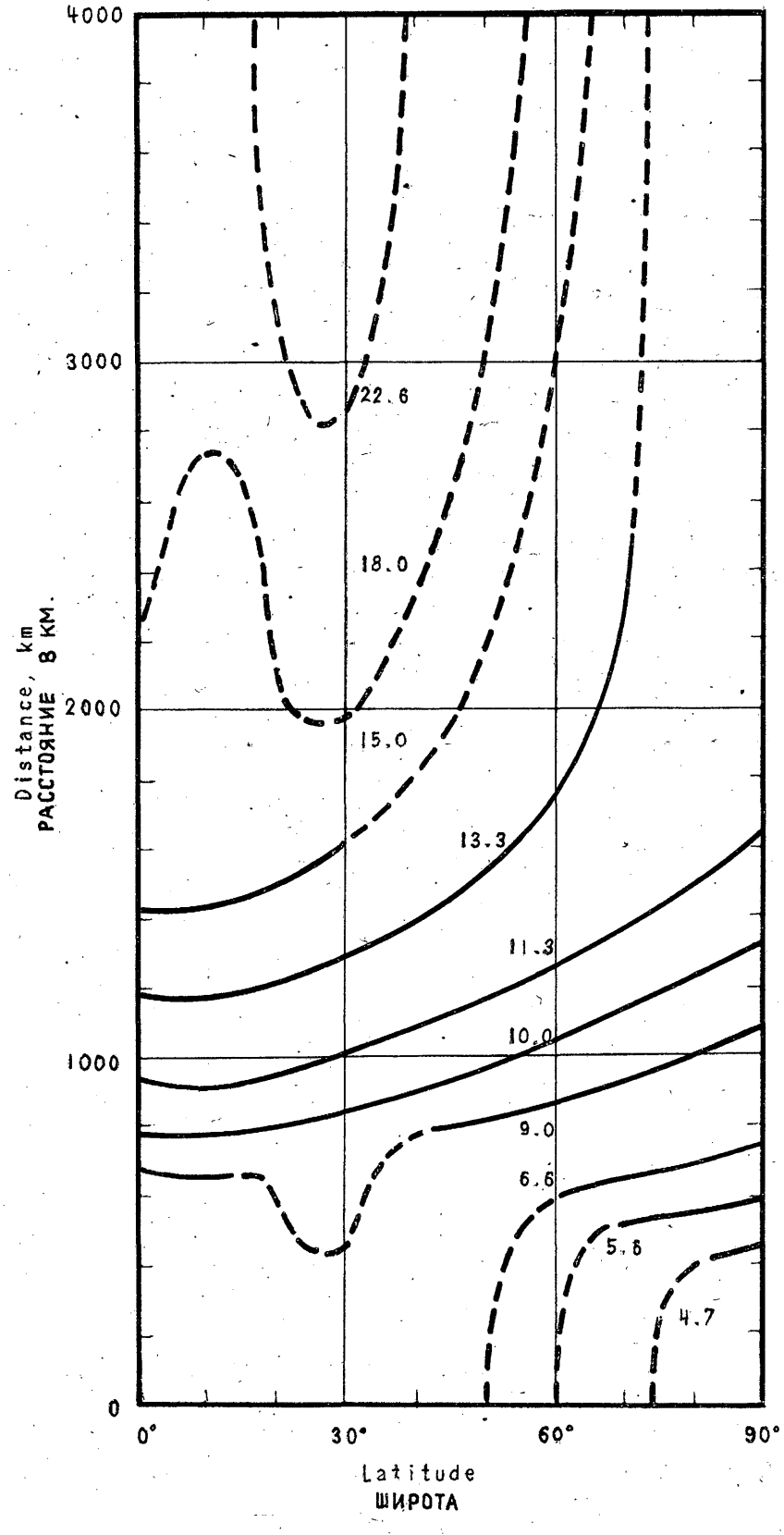

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
0°
30°
60°
90°
Latitude
ШИРОТА

Fig.9 Рис.9

Fig. 10. Portées minimum à midi au mois de décembre, zone W, hémisphère sud, 125 taches solaires.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 10. Minimum distance range, noon, December, W-zone, southern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 10. Alcance mínimo, mediodía, diciembre, zona-W, hemisferio austral, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.10. Минимальная дальность действия, полдень, декабрь, зона-W, южное полушарие, число солнечных пятен 125. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - - Слой F_2 ОРЧ

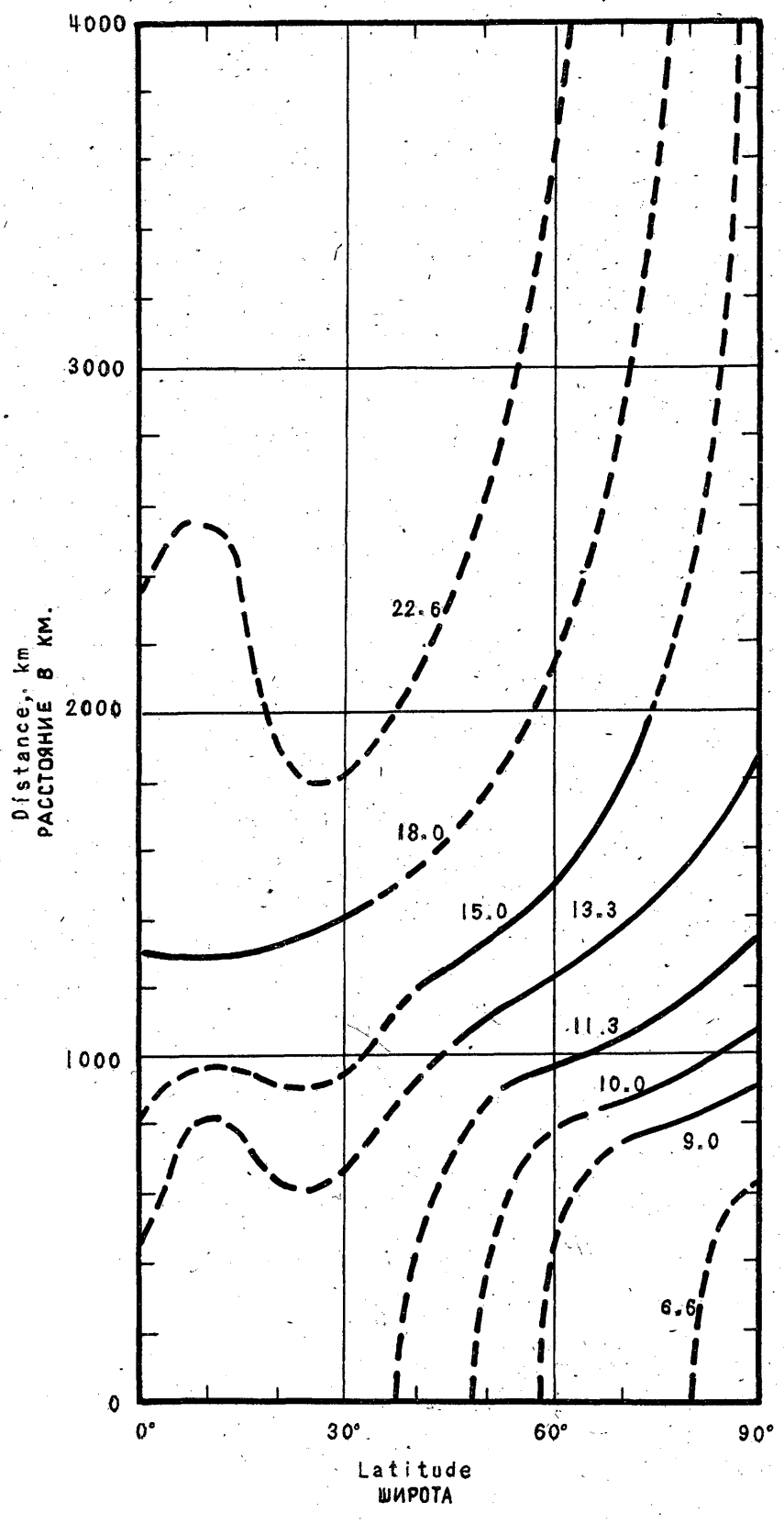

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 10 Рис. 10

Fig. 11. Portées minimum à midi au mois de juin, zone I, hémisphère nord, 0 tache solaire.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 11. Minimum distance range, noon, June, I-zone, northern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 11. Alcance mínimo, mediodía, junio, zona I, hemisferio septentrional, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.11. Минимальная дальность действия, полдень, июнь, зона- I , северное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - Слой F2 ОРЧ.

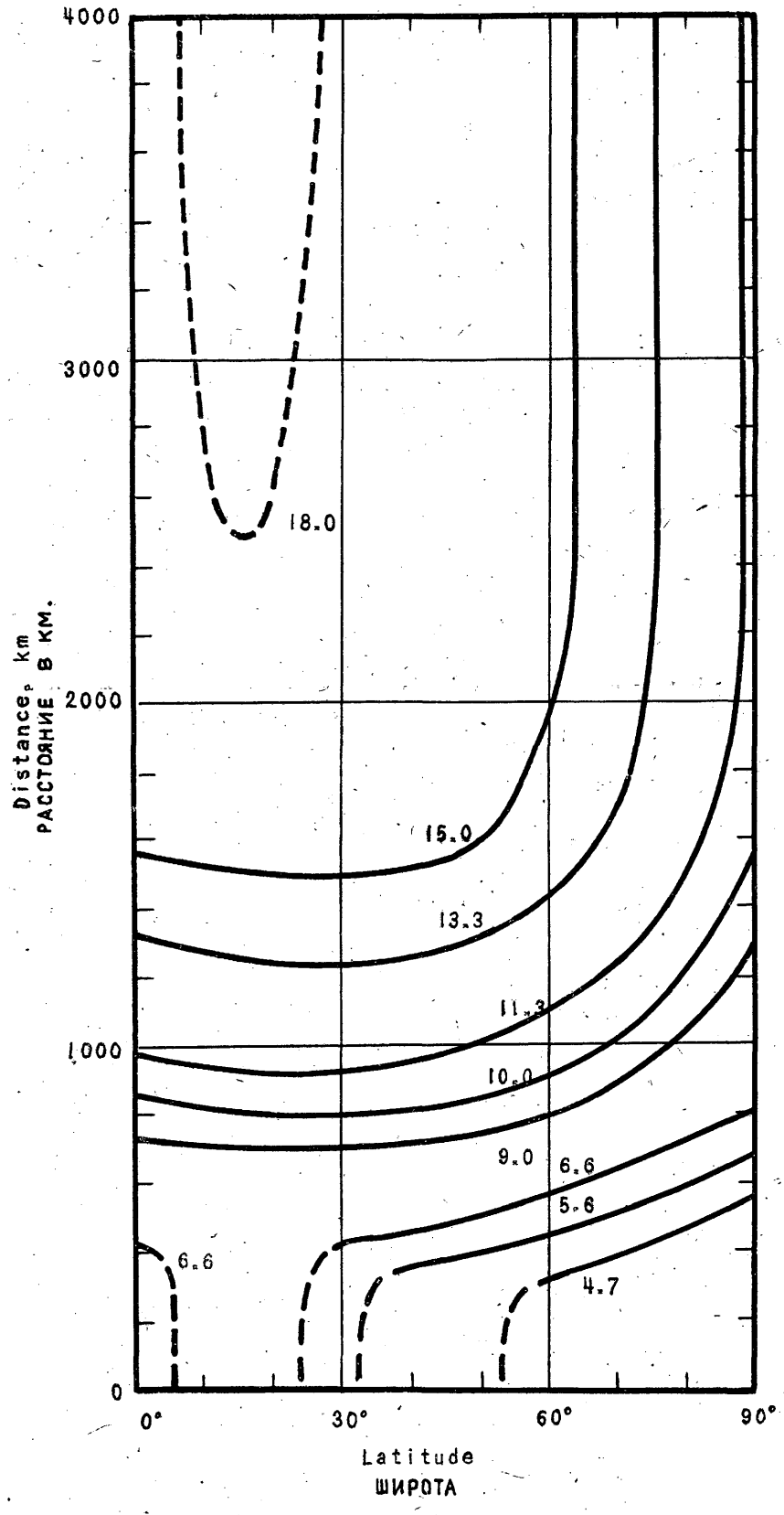

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
6.6
0°
30°
60°
90°
Latitude
ШИРОТА

Fig.11 Рис.11

Fig. 12. Portées minimum à midi au mois de juin, zone I, hemisphère nord, 125 taches solaires.

les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig.12. Minimum distance range, noon, June, I-zone, northern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 12. Alcance mínimo, mediodía, junio, zona I, hemisferio septentrional, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.12. Минимальная дальность действия, полдень, июнь, зона - I, северное полушарие, число солнечных пятен 125. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - - Слой F2 ОРЧ

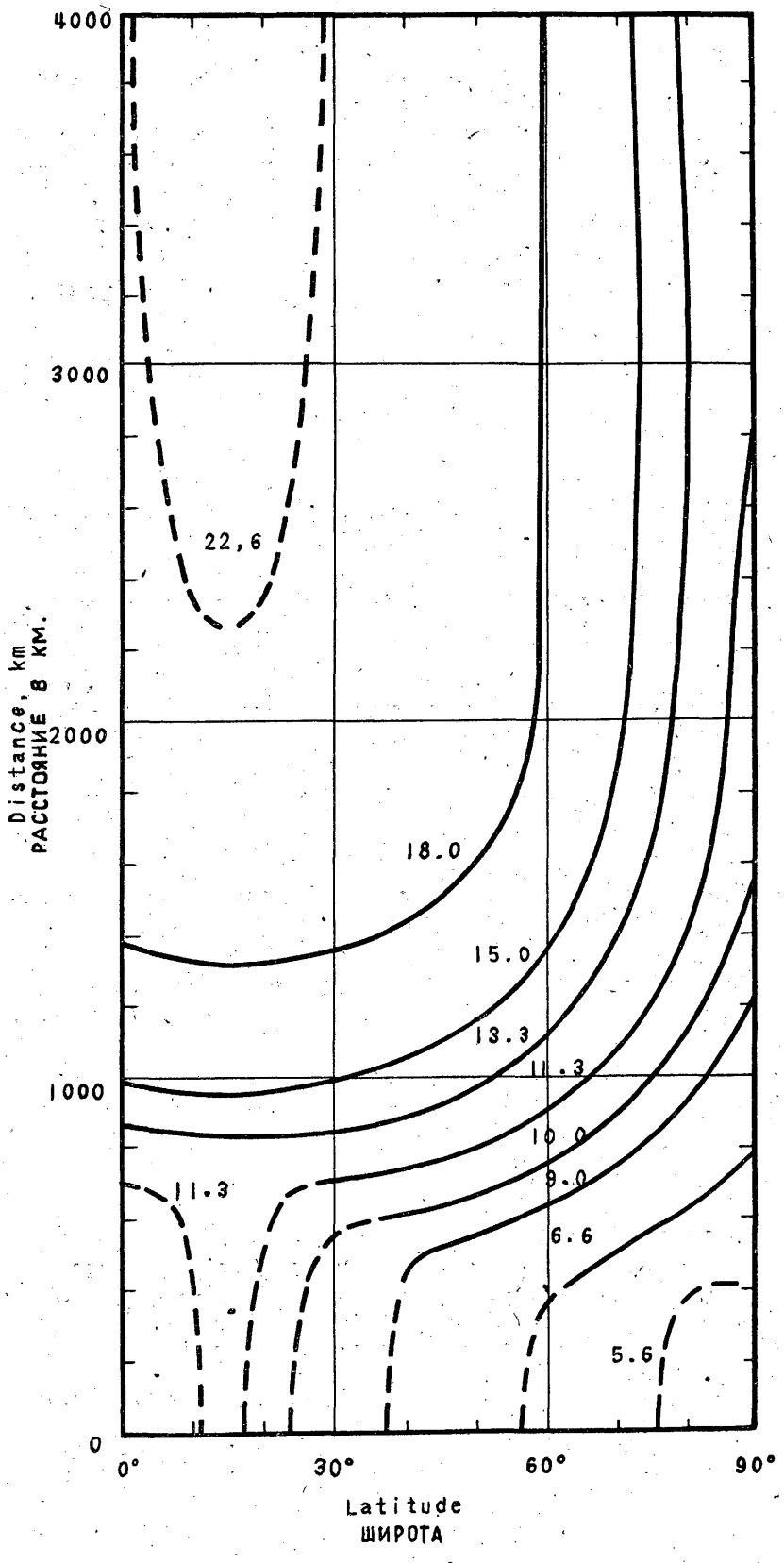

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22,6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
11.3
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 12 Рис.12

Fig. 13. Portées minimum à midi au mois de décembre, zone I, hémisphère sud, 0 tache solaire.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 13. Minimum distance range, noon, December, I-zone, southern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 13. Alcance mínimo, mediodía, diciembre, zona I, hemisferio austral, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.13. Минимальная дальность действия, полдень, декабрь, зона - I, южное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - Слой F2 ОРЧ

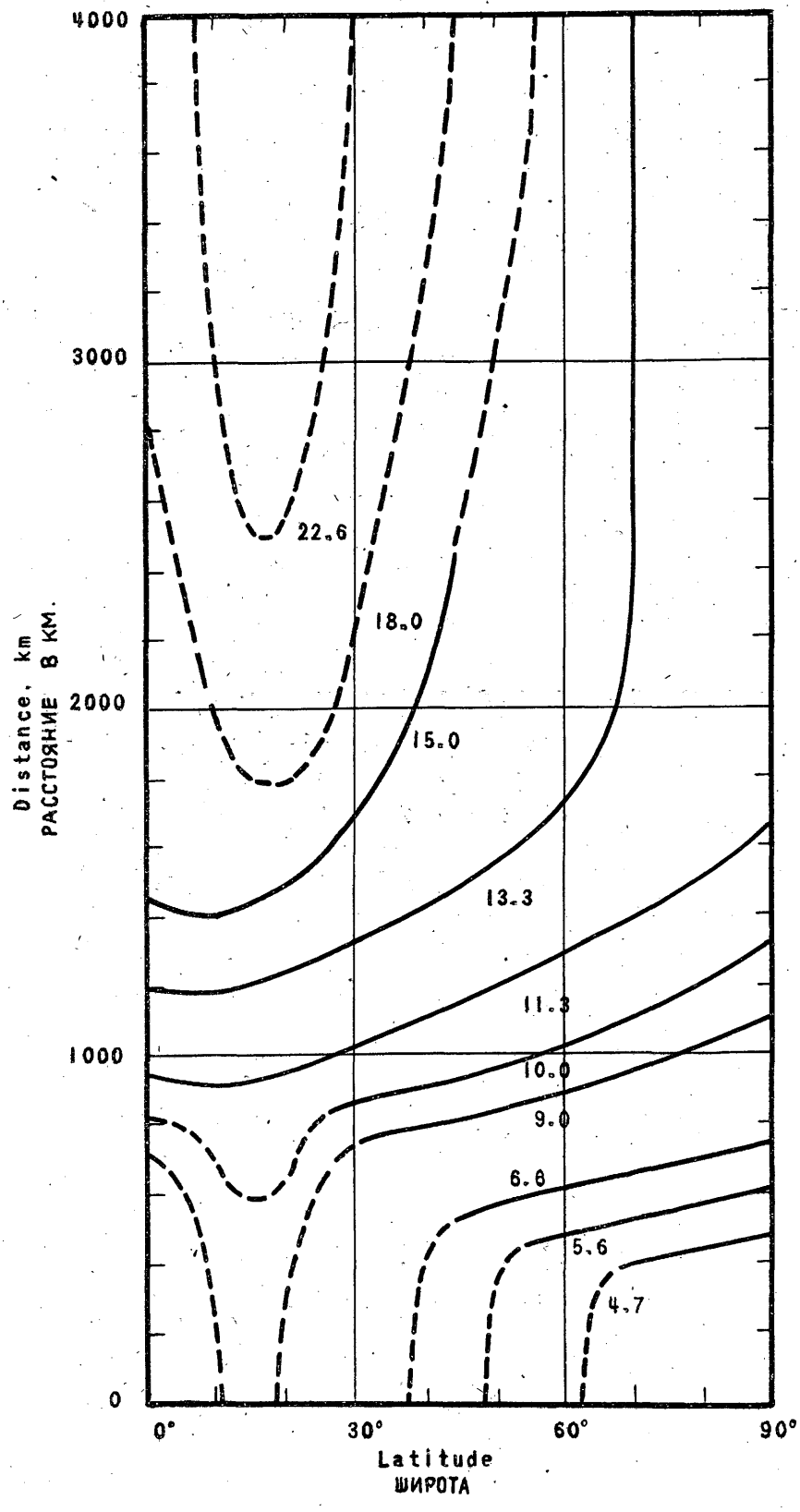

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 13 Рис. 13

Fig. 14. Portées minimum à midi au mois de décembre, zone I, hémisphère sud, 125 taches solaires.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 14. Minimum distance range, noon, December, I-zone, southern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 14. Alcance mínimo, mediodía, diciembre, zona I, hemisferio austral, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис. 14. Минимальная дальность действия, полдень, декабрь, зона - I, южное полушарие, число солнечных пятен 125. Цифры на кривых обозначают частоту в мгц.

——— Слой-Е МПЧ - - - -Слой F2 ОРЧ.

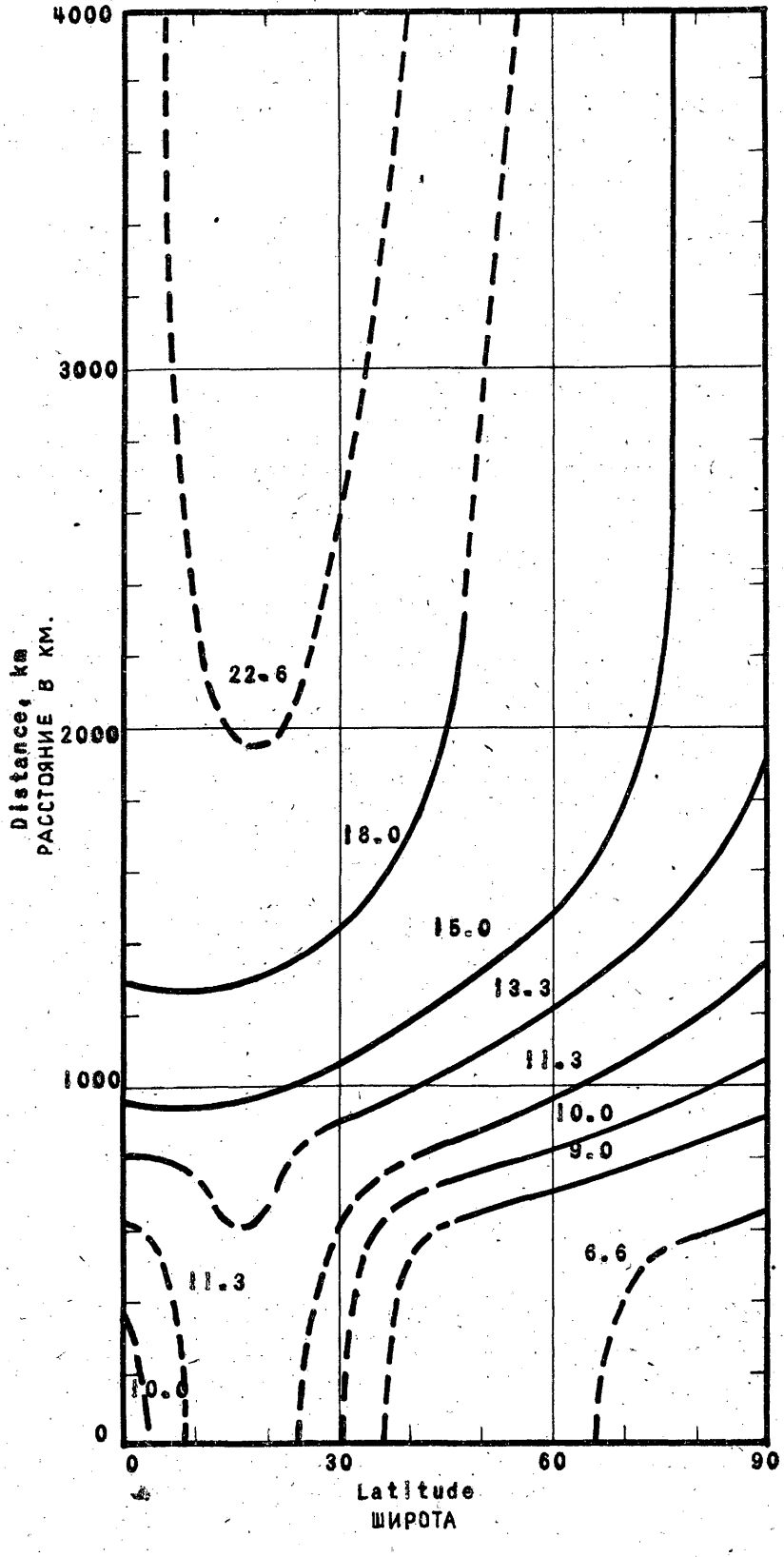

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
11.3
10.0
0
30
60
90
Latitude
ШИРОТА

Fig. 14 Рис. 14

Fig. 15. Portées minimum, à midi au mois de juin, zone E, hémisphère nord, 0 tache solaire.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 15. Minimum distance range, noon, June, E-zone, northern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

E-layer MUF - - - - F2- layer OWF

Fig. 15. Alcance mínimo, mediodía, junio, zona-E, Hemisferio septentrional, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.15. Минимальная дальность действия, полдень, июнь, зона-Е, северное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - Слой F2 ОРЧ.

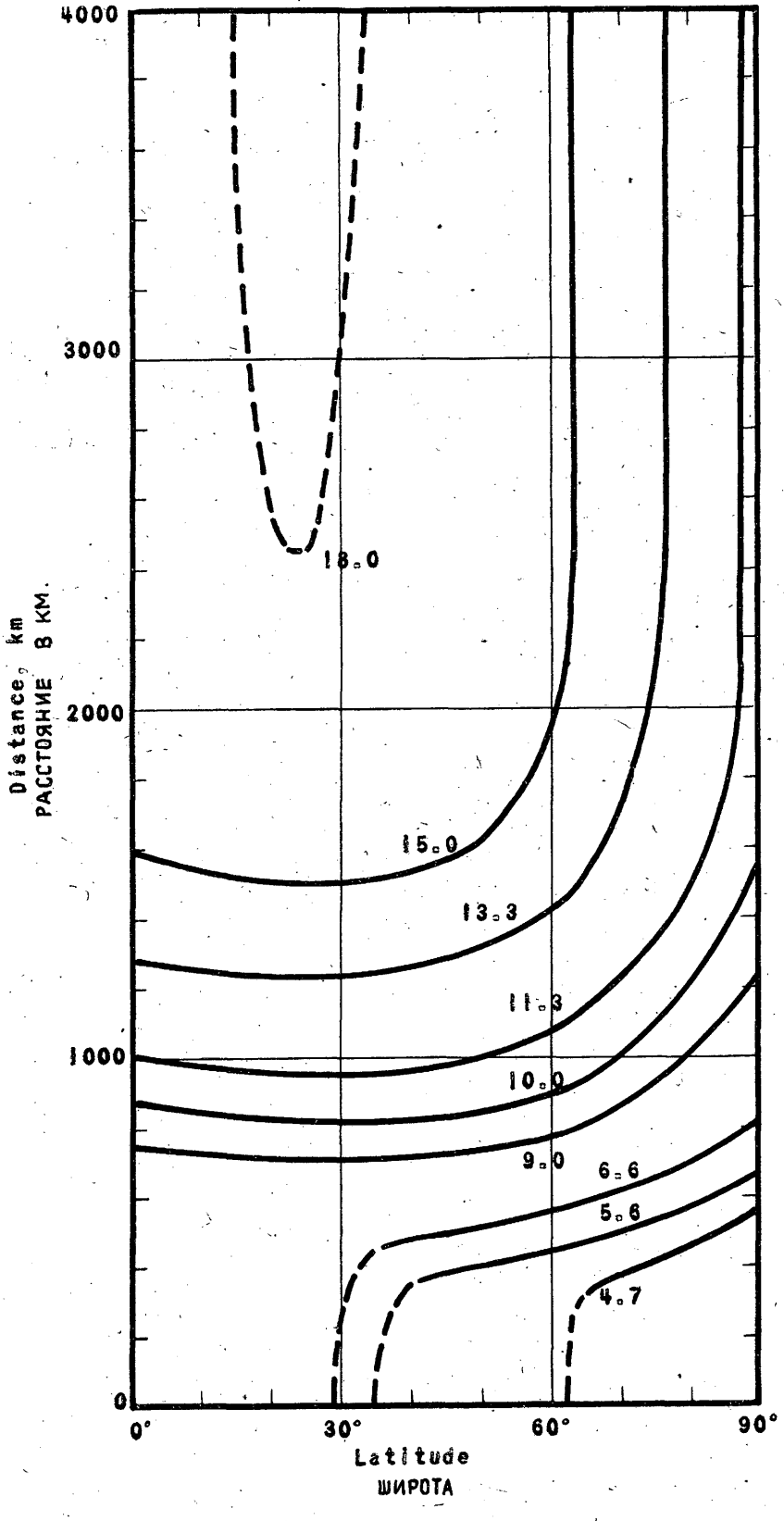

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 15 Рис. 15

Fig. 16. Portées minimum à midi au mois de juin, zone E, hémisphère nord, 125 taches solaires.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 16. Minimum distance range, noon, June, E-zone, northern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 16. Alcance mínimo, mediodía, junio, zona-E, hemisferio septentrional, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.16. Минимальная дальность действия, полдень, июнь, зона-Е, северное полушарие, число солнечных пятен 125. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - - Слой F2 ОРЧ

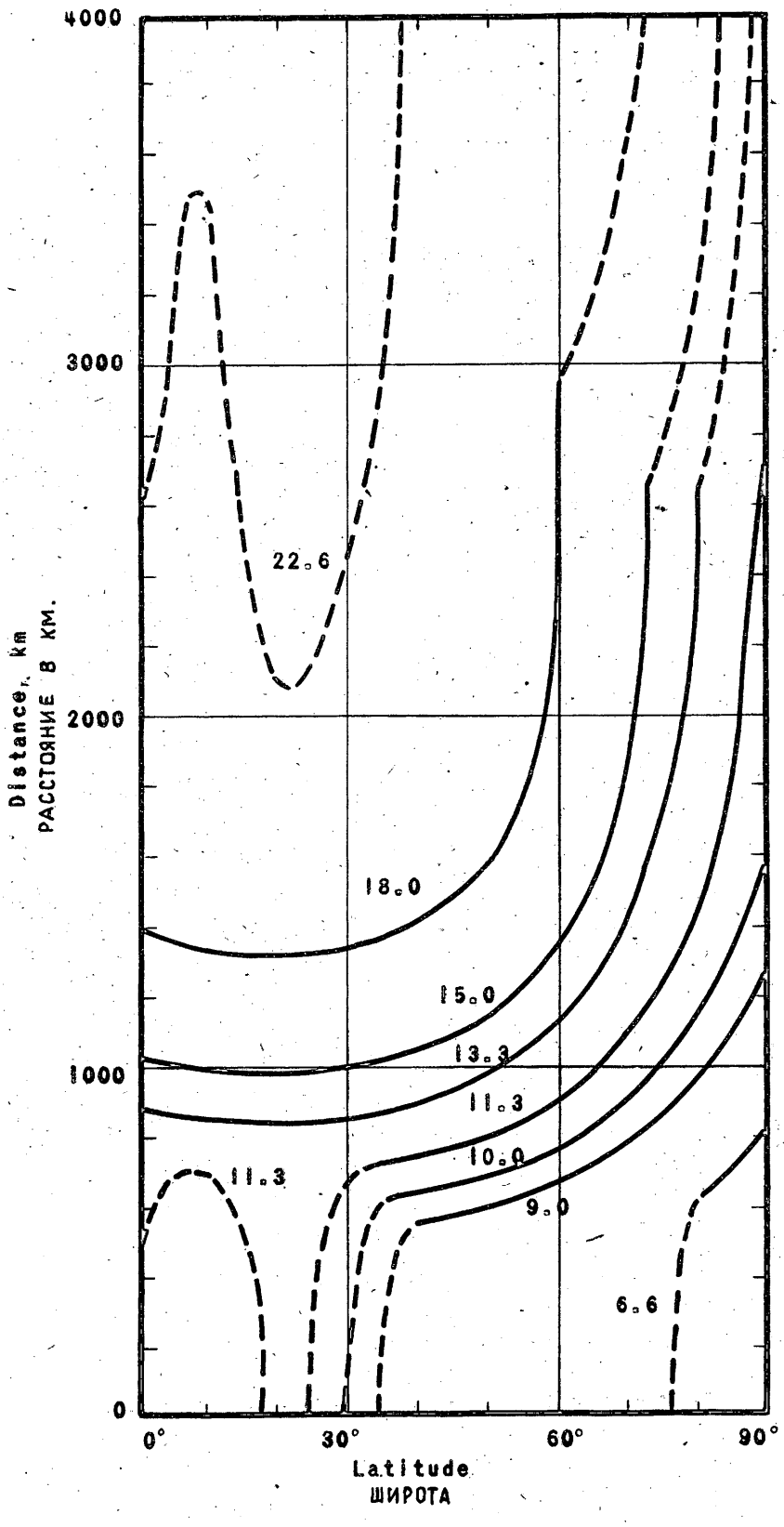

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
11.3
6.6
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 16 Рис. 16

Fig. 17. Portées minimum à midi au mois de décembre, zone E, hémisphère sud, 0 tache solaire.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2.

Fig. 17. Minimum distance range, noon, December, E-zone, southern hemisphere, sunspot number 0.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 17. Alcance mínimo, mediodía, diciembre, zona-E, hemisferio austral, actividad solar 0.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.17. Минимальная дальность действия, полдень, декабрь, зона -Е, южное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - - Слой F2 ОРЧ.

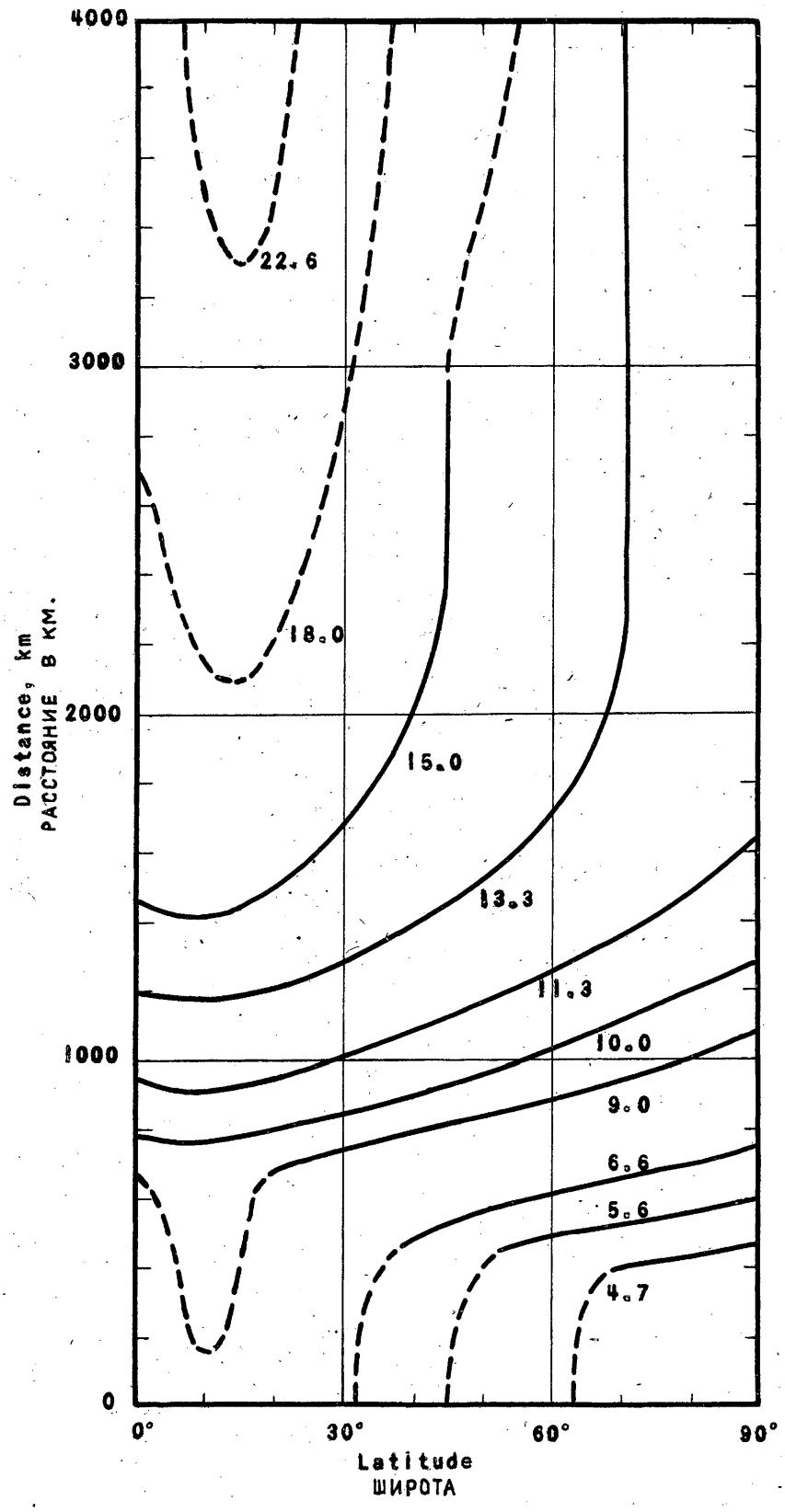

4000
3000
2000
1000
0
Distance, km
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
0°
30°
60°
90°
Latitude
ШИРОТА

Fig.17 Рис.17

Fig. 18. Portées minimum à midi au mois de décembre, zone E, hémisphère sud, 125 taches solaires.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— FMU couche E - - - - FOT couche F2

Fig. 18. Minimum distance range, noon, December, E-zone, southern hemisphere, sunspot number 125.

Figures on curves are Mc/s.

———— E-layer MUF - - - - F2-layer OWF

Fig. 18. Alcance mínimo, mediodía, diciembre, zona-E, hemisferio austral, actividad solar 125.

Las cifras que figuran en las curvas representan Mc/s.

———— FMU capa E - - - - FOT capa F2

Рис.18. Минимальная дальность действия, полдень, декабрь, зона-Е , южное полушарие, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Слой-Е МПЧ - - -Слой F2 ОРЧ

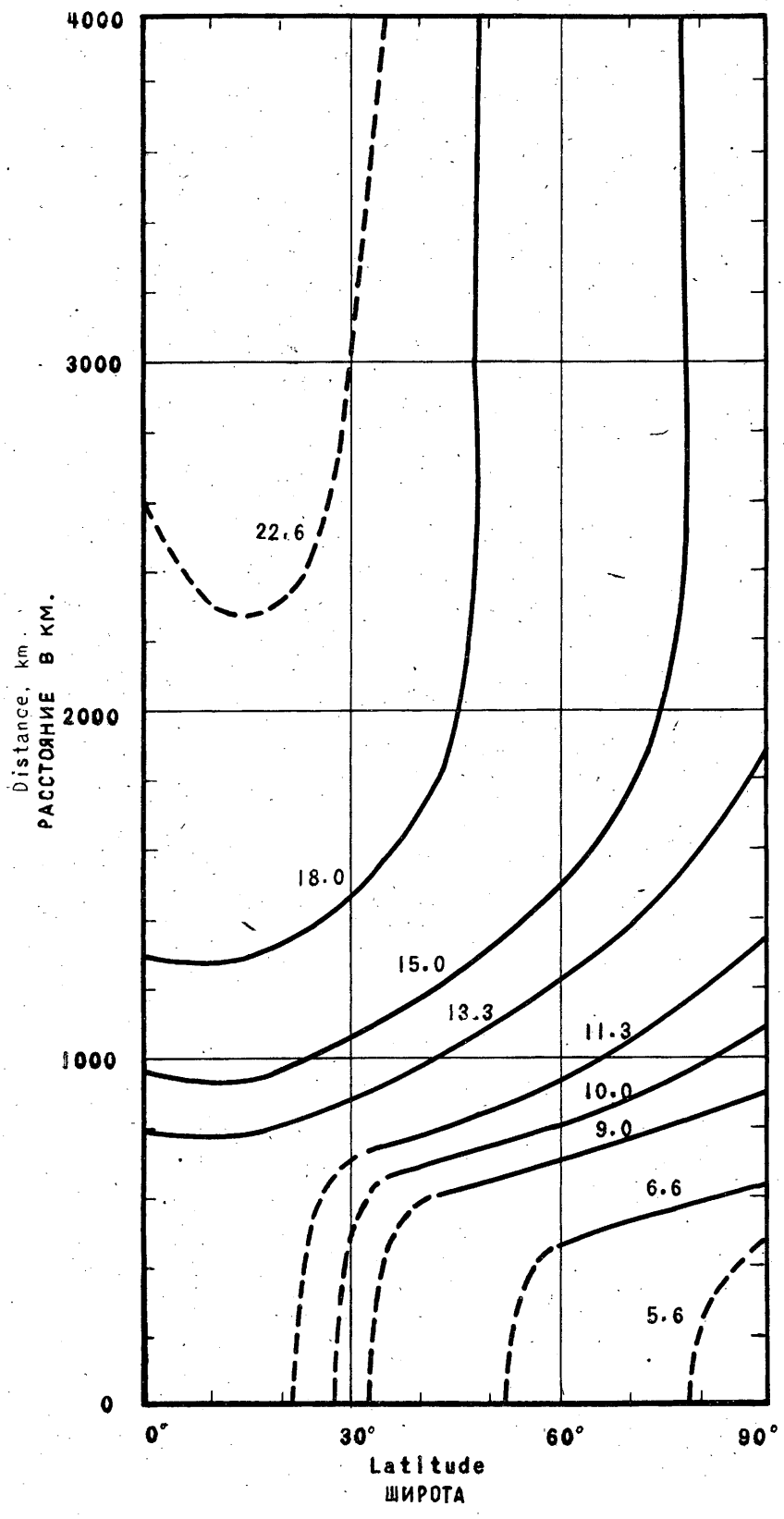

4000
3000
2000
1000
0
Distance, km.
РАССТОЯНИЕ В КМ.
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 18 Рис. 18

Fig. 19. Portées minimum (FMU F2), zone W, heure locale 20.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 19. Minimum distance range (F2 MUF), W-zone, 2000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

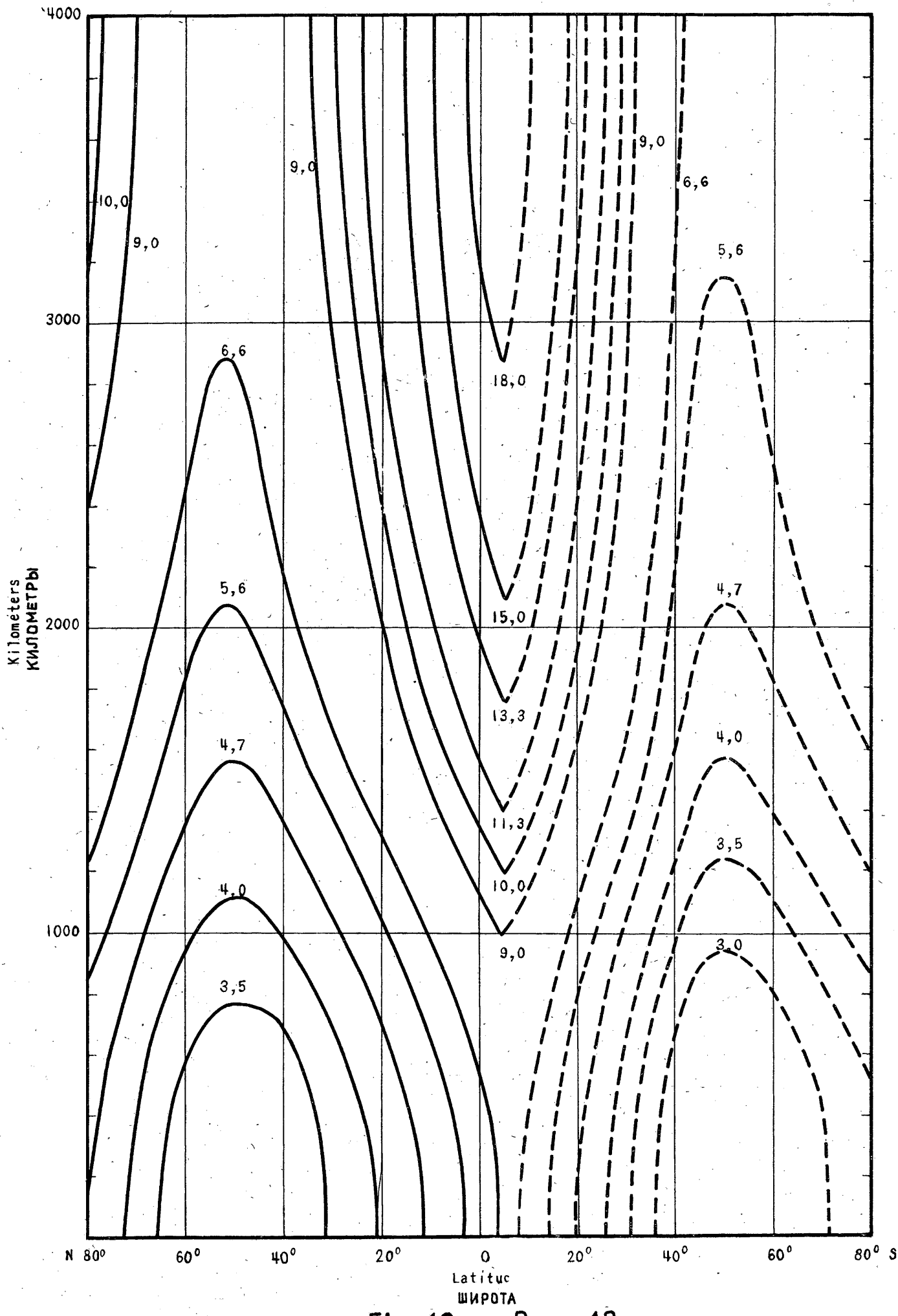
Fig. 19. Alcance mínimo (FMU F2), zona-W, 2000 hora local en el punto medio del trayecto, actividad solar 0.

los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис.19. Минимальная дальность действия (МПЧ F2), зона W , 20ч.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— Декабрь - - - - - - - - июнь


4000
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Kilometers
КИЛОМЕТРЫ
10,0
9,0
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18,0
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N 80°
60°
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20°
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80° S
Latituc
ШИРОТА

Fig. 19 Рис. 19

Fig. 20. Portées minimum (FMU F2), zone W, heure locale 00.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 20. Minimum distance range (F2MUF), W-zone, 0000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

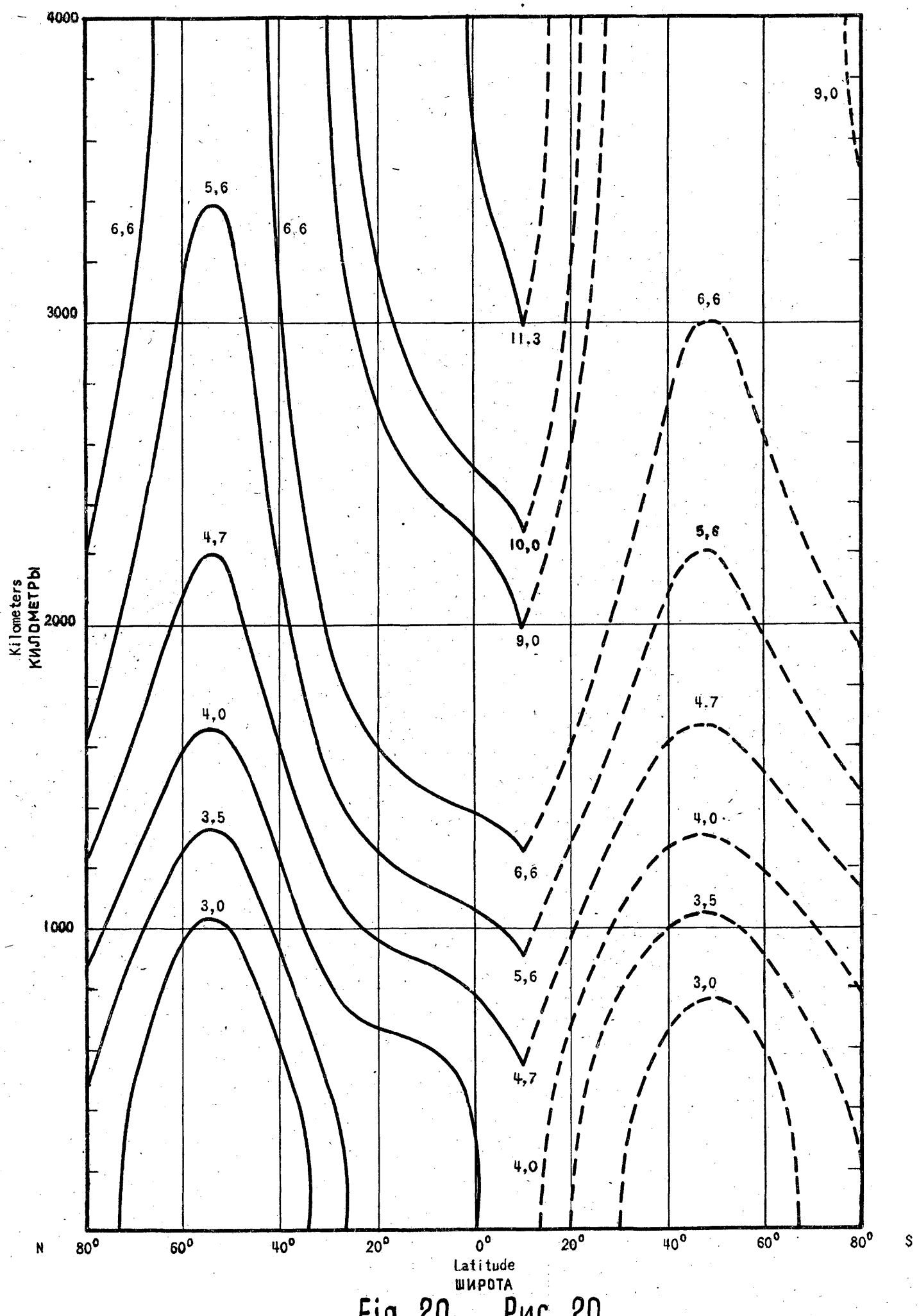
Fig. 20. Alcance mínimo (FMU F2), zona W, 0000 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис. 20. Минимальная дальность действия (МПЧ F2), зонаW , 00ч.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— декабрь - - - - - июнь


4000
3000
2000
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Kilometers
КИЛОМЕТРЫ
6,6
5,6
6,6
9,0
11,3
6,6
10,0
5,6
9,0
4,7
4,0
4,7
3,5
4,0
6,6
3,0
3,5
5,6
3,0
4,7
4,0
N
80°
60°
40°
20°
0°
20°
40°
60°
80°
S
Latitude
ШИРОТА

Fig. 20 Рис. 20

Fig. 21. Portées minimum (FMU F2), zone W, heure locale 04.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

————— décembre - - - - juin

Fig. 21. Minimum distance range (F2 MUF), W-zone, 0400 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

————— December - - - - June

Fig. 21. Alcance mínimo (FMU F2), zona-W, 0400 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

————— diciembre - - - - junio

Рис. 21. Минимальная дальность действия (МПЧ F2), зона-W, 04.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

————— декабрь - - - - - - июнь

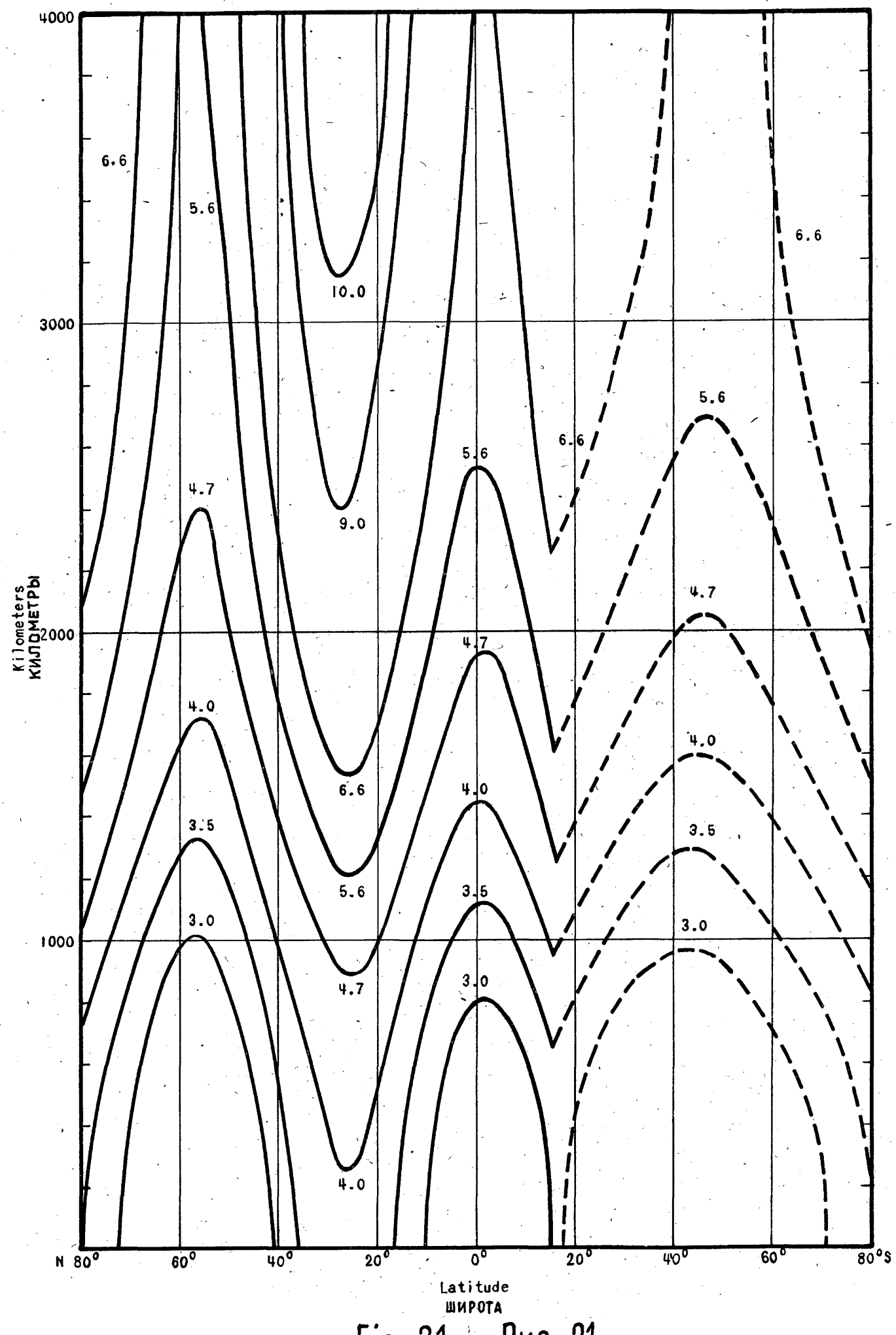

4000
3000
2000
1000
Kilometers
КИЛОМЕТРЫ
6.6
5.6
10.0
9.0
6.6
5.6
4.7
5.6
6.6
4.7
4.7
4.0
6.6
4.0
3.5
5.6
4.0
3.5
3.0
4.7
3.5
3.0
4.0
N 80°
60°
40°
20°
0°
20°
40°
60°
80°S
Latitude
ШИРОТА

Fig. 21 Рис. 21

Fig. 22. Portées minimum (FMU F2), zone I, heure locale 20.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 22. Minimum distance range (F2 MUF), I-zone, 2000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

Fig. 22. Alcance mínimo (FMU F2), zona-I, 2000 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис.22. Минимальная дальность действия (МПЧ F2), зона-I, 20ч. 00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— декабрь - - - - июнь

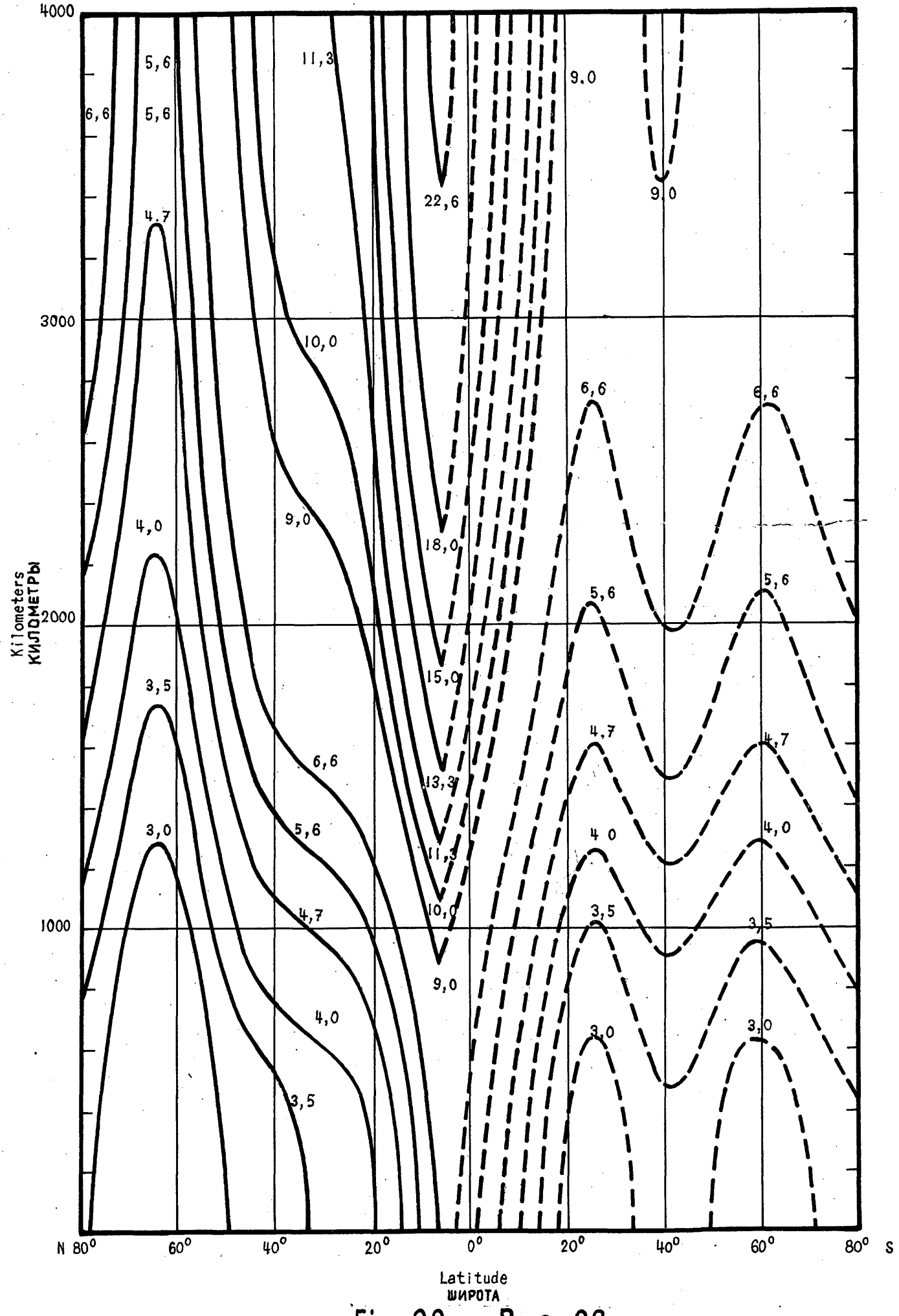

4000
3000
2000
1000
Kilometers
КИЛОМЕТРЫ
N 80° 60° 40° 20° 0° 20° 40° 60° 80° S
Latitude
ШИРОТА
5,6
6,6
5,6
11,3
9.0
22,6
9,0
4,7
10,0
6,6
6,6
4,0
9,0
18,0
5,6
5,6
15,0
3,5
4,7
4,7
13,3
6,6
4 0
4,0
3,0
5,6
11,3
3,5
3,5
4,7
10,0
9,0
4,0
3,0
3,0
3,5

Fig. 22 Рис. 22

Fig. 23. Portées minimum (FMU F2), zone I, heure locale 00.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 23. Minimum distance range (F2 MUF), I-zone, 0000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

Fig. 23. Alcance mínimo (FMU F2), zona-I, 0000 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис.23. Минимальная дальность действия (МПЧ F2), зона I, 00ч.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифрн на кривых обозначают частоту в мгц.

———— Декабрь - - - - - - июнь

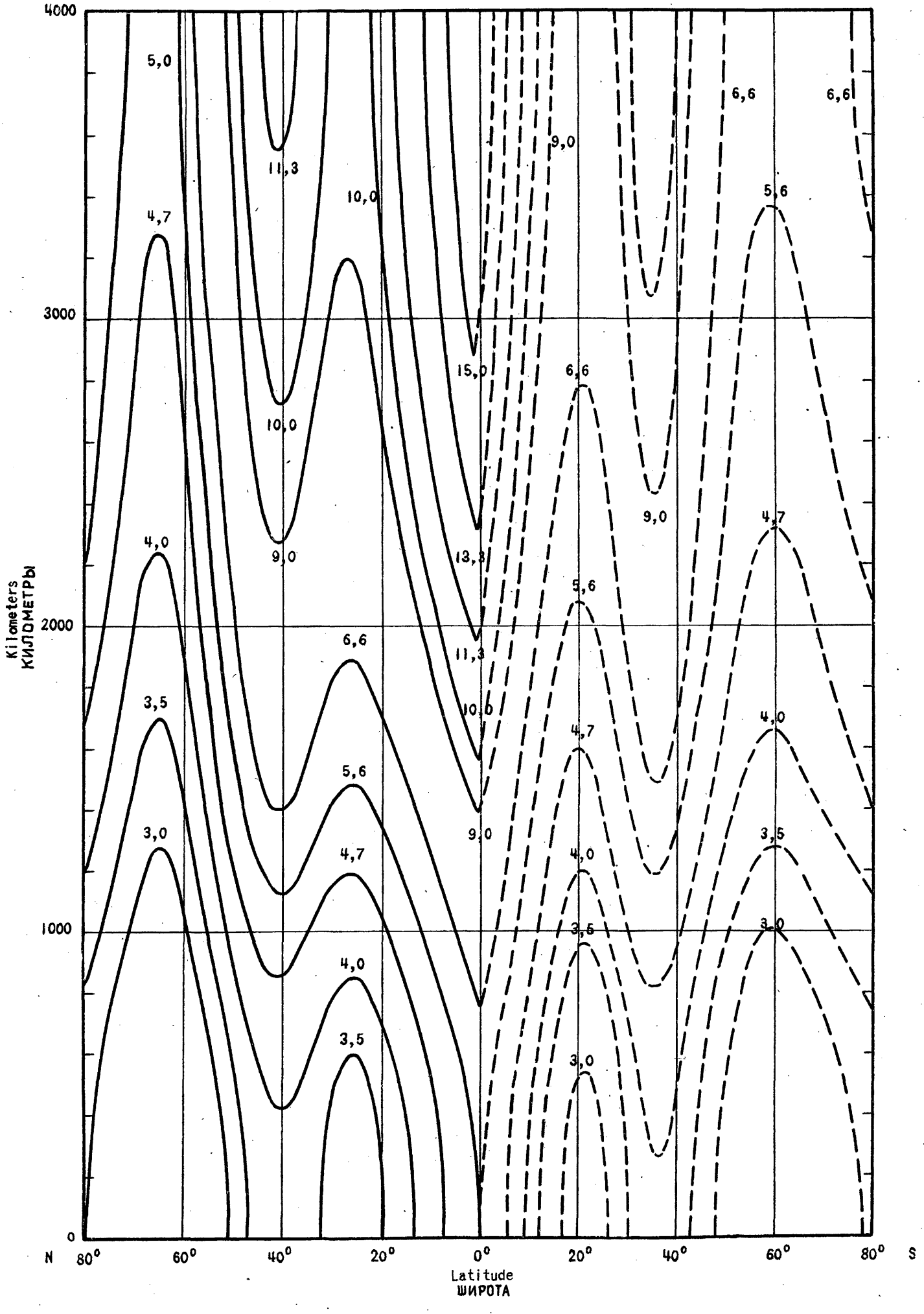

4000
3000
2000
1000
0
Kilometers
КИЛОМЕТРЫ
N
80°
60°
40°
20°
0°
20°
40°
60°
80°
S
Latitude
ШИРОТА
5,0
4,7
4,0
3,5
3,0
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,6
3,0
9,0
6,6
6,6
5,6
4,7
4,0
3,5
3,0

Fig. 23 Рис. 23

Fig. 24. Portées minimum (FMU F2), zone I, heure locale 0400 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 24. Minimum distance range (F2 MUF), I-zone, 0400 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

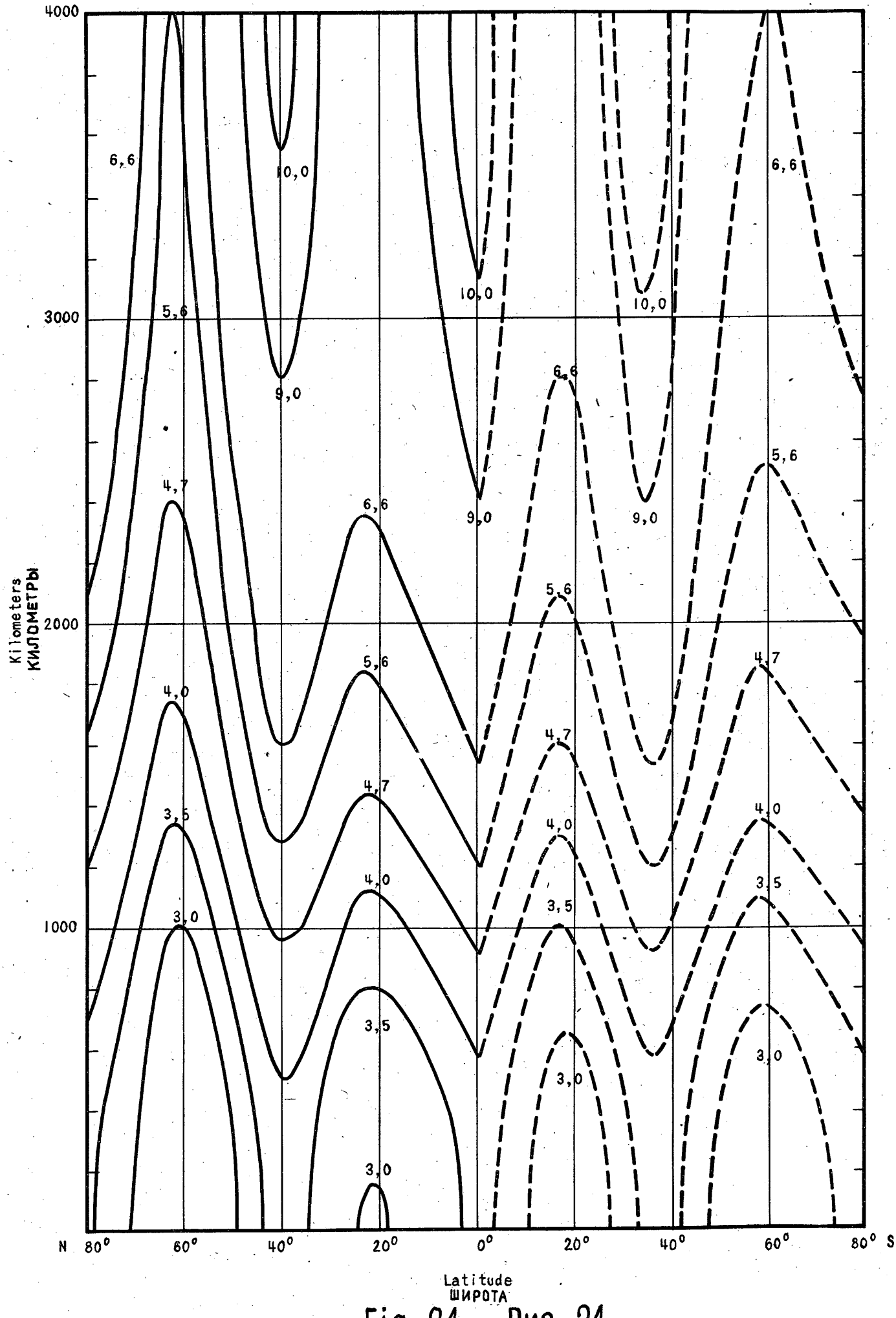
Fig. 24. Alcance mínimo (FMU F2), zona-I, 0400 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис. 24. Минимальная дальность действия (МПЧ F2), зона-I, 04ч. 00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— декабрь - - - - июнь


4000
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Kilometers
КИЛОМЕТРЫ
N
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60°
40°
20°
0°
20°
40°
60°
80°
S
Latitude
ШИРОТА
6,6
10,0
5,6
9,0
4,7
6,6
4,0
5,6
3,5
4,7
3,0
4,0
3,5
3,0
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
6,6
10,0
9,0
5,6
4,7
4,0
3,5
3,0

Fig. 24 Рис. 24

Fig. 25. Portées minimum (FMU F2), zone E, heure locale 20.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 25. Minimum distance range (F2 MUF), E-zone, 2000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

Fig. 25. Alcance mínimo (FMU F2), zona-E, 2000 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис. 25. Минимальная дальность действия (МПЧ F2), зона-Е, 20ч. 00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———— декабрь - - - - июнь

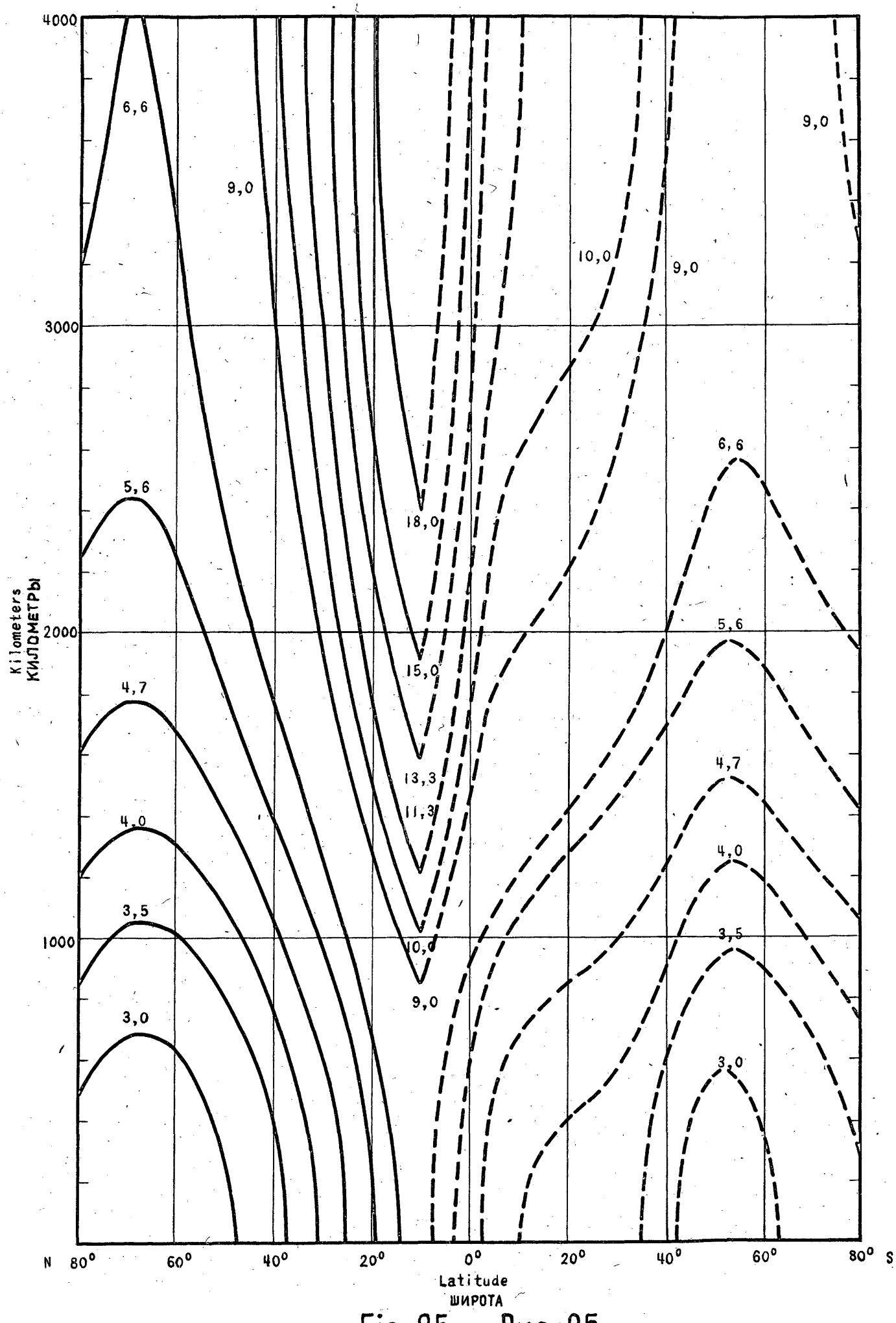

4000
3000
2000
1000
Kilometers
КИЛОМЕТРЫ
6,6
9,0
5,6
4,7
4,0
3,5
3,0
18,0
15,0
13,3
11,3
10,0
9,0
10,0
9,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
N
80°
60°
40°
20°
0°
20°
40°
60°
80°
S
Latitude
ШИРОТА

Fig. 25 Рис. 25

Fig. 26. Portées minimum (FMU F2), zone E, heure locale 00.00 au point milieu du trajet, activité solaire minimum.

les chiffres figurant sur les courbes représentent des Mc/s.

———— décembre - - - - juin

Fig. 26. Minimum distance range (F2 MUF), E-zone, 0000 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

———— December - - - - June

Fig. 26. Alcance mínimo (FMU F2), zona-E, 0000 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

———— diciembre - - - - junio

Рис.26. Минимальная дальность действия (МПЧ F2), зона-Е,00ч.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

————Декабрь - - - - - - июнь

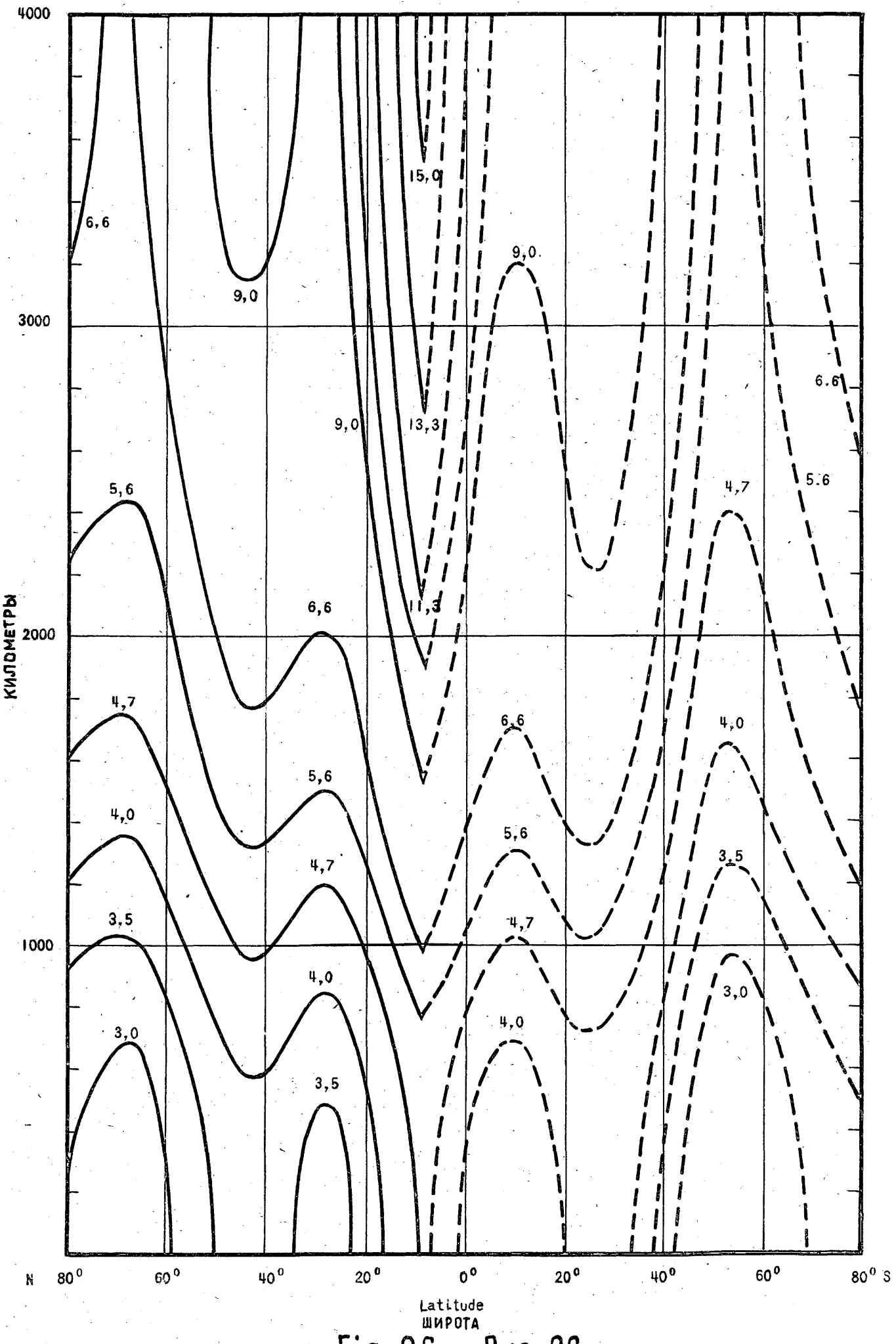

4000
3000
2000
1000
КИЛОМЕТРЫ
6,6
9,0
15,0
9,0
9,0
13,3
6.6
5,6
11,3
4,7
5.6
6,6
4,7
6,6
4,0
5,6
4,0
5,6
4,7
3,5
3,5
4,7
4,0
3,0
3,0
4,0
3,5
N 80° 60° 40° 20° 0° 20° 40° 60° 80° S
Latitude
ШИРОТА

Fig. 26 Рис. 26

Fig. 27. Portées minimum (FMU F2), zone E, heure locale 04.00 au point milieu du trajet, activité solaire minimum.

Les chiffres figurant sur les courbes représentant des Mc/s.

——— décembre - - - - juin

Fig. 27. Minimum distance range (F2 MUF), E-zone, 0400 local time at the midpoint of the path, sunspot number 0.

Figures on curves are Mc/s.

——— December - - - - June

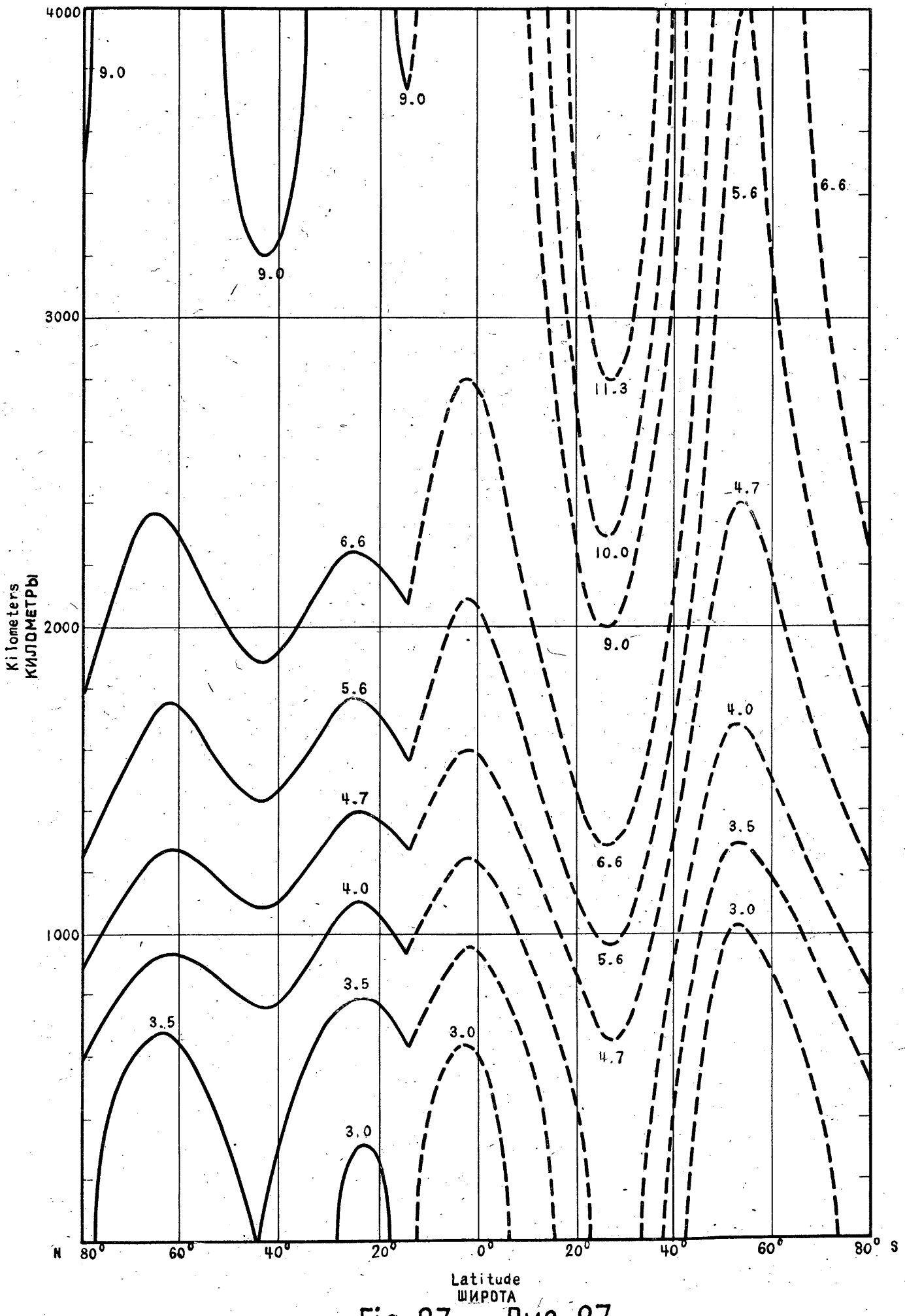
Fig. 27. Alcance máximo (FMU F2), zona-E, 0400 hora local en el punto medio del trayecto, actividad solar 0.

Los números en las curvas indican la frecuencia en Mc/s.

——— diciembre - - - - junio

Рис. 27. Минимальная дальность действия (МПЧ F2), зона -Е, 04ч.00м. местного времени в средней точке линии связи, число солнечных пятен 0. Цифры на кривых обозначают частоту в мгц.

———Декабрь - - - - - -июнь


4000
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Kilometers
КИЛОМЕТРЫ
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5.6
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11.3
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6.6
10.0
9.0
5.6
4.0
4.7
3.5
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4.0
3.0
5.6
3.5
4.7
3.5
3.0
3.0
N
80°
60°
40°
20°
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20°
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80°
S
Latitude
ШИРОТА

Fig. 27 Рис. 27

Fig. 28. Portées maximum à midi pour la radiotéléphonie, limitée par les parasites atmosphériques à la station terrestre, avec une puissance de crête de 200 watts rayonnée par l'aéronef, ou limitée par le niveau des parasites d'origine locale à bord de l'aéronef (intensité du champ nécessaire: 20 μv/m), avec une puissance de crête de 4 kW rayonnée par la station terrestre. Juin dans l'hémisphère nord, décembre dans l'hémisphère sud, équinoxe entre 10° N et 10° S, activité solaire 0. Portée conditionnée par des FMU suffisamment hautes.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— parasites atmosphériques - - - - parasites d'origine locale.

Fig. 28. Maximum distance range for radiotelephone at noon as limited by atmospheric noise at the ground station with 200 watts peak power radiated by the aircraft, or by aircraft noise (20 μv/m required field intensity) with 4 kW peak power radiated by the ground station. June in the northern hemisphere, December in the southern hemisphere, equinox between 10° N and 10° S. Sunspot number 0. Subject to sufficiently high MUF.

Figures on curves are Mc/s.

———— Atmospheric noise - - - - Aircraft noise.

Fig. 28. Alcance máximo para radiotelefonía, al mediodía, limitado por el ruido atmosférico en la estación de tierra, con una potencia máxima de 200 vatios irradiada por la aeronave, o por el ruido de la aeronave (intensidad de campo requerida 20 μv/m) con una potencia máxima de 4 kilovatios irradiada por la estación de tierra. Junio en el hemisferio septentrional, diciembre en el hemisferio austral, equinoccio entre 10° N y 10° S. Actividad solar 0. Sujeto a una FMU suficientemente elevada.

Los números de las curvas indican la frecuencia en Mc/s.

———— Ruido atmosférico - - - - Ruido de la aeronave

Рис. 28. Максимальная дальность действия при радиотелефонии в полдень, ограниченная для наземной станции атмосферными помехами при пиковой мощности излучения самолета в 200 ватт или самолетными помехами (при требуемой напряженности поля в 20 мкв/м) при пиковой мощности излучения наземной станции в 4 квт. Июнь в северном полушарии, декабрь в южном полушарии, равноденствие между 10° северной и 10° южной широты. Число солнечных пятен 0. При условии достаточно высокой МПЧ. Цифры на кривых обозначают частоту в мгц.

———— Атмосферные помехи - - - Помехи на самолете

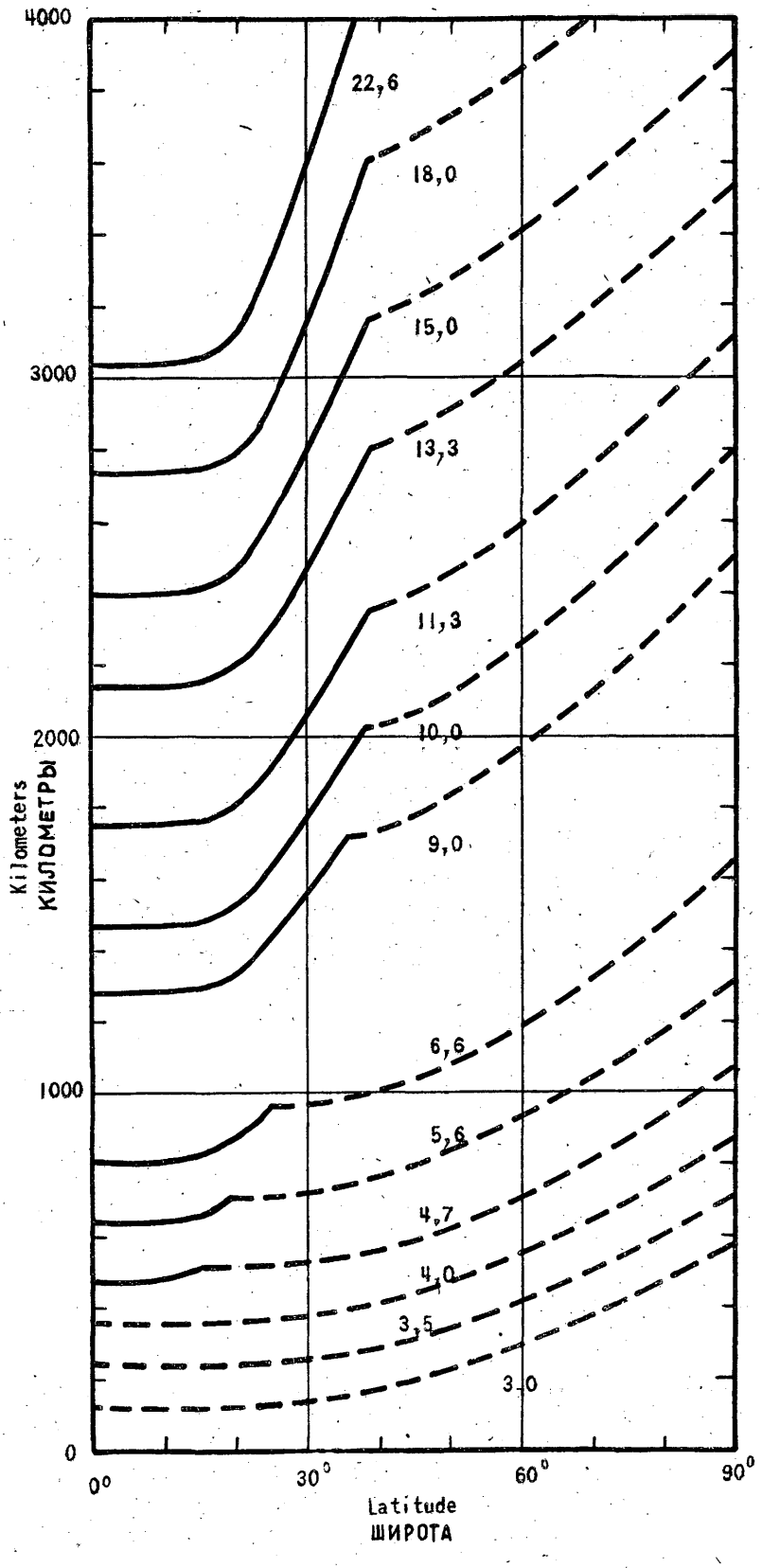

4000
3000
2000
1000
0
Kilometers
КИЛОМЕТРЫ
22,6
18,0
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 28 Рис. 28

Fig. 29. Portées maximum à midi pour la radiotéléphonie, limitée par les parasites atmosphériques à la station terrestre, avec une puissance de crête de 200 watts, rayonnée par l'aéronef, ou limitée par le niveau des parasites d'origine locale à bord de l'aéronef (intensité du champ nécessaire: 20 μv/m) avec une puissance de crête de 4 kW, rayonnée par la station terrestre. Juin dans l'hémisphère nord, décembre dans l'hémisphère sud. équinoxe entre 10° N et 10° S. Activité solaire 125. Portée conditionnée par des FMU suffisamment hautes.

Les chiffres figurant sur les courbes représentent des Mc/s.

———— parasites atmosphériques - - - - parasites d'origine locale

Fig. 29. Maximum distance range for radiotelephone at noon as limited by atmospheric noise at the ground station with 200 watts peak power radiated by the aircraft, or by aircraft noise 20 μv/m required field intensity) with 4 kW peak power radiated by the ground station. June in the northern hemisphere, December in the southern hemisphere, equinox between 10° N and 10° S. Sunspot number 125. Subject to sufficiently high MUF.

Figures on curves are Mc/s.

———— Atmospheric noise - - - - Aircraft noise

Fig. 29. Alcance máximo para radiotelefonía, al mediodía, limitado por el ruido atmosférico en la estación de tierra con una potencia máxima de 200 vatios irradiada por la aeronave, o por el ruido de la aeronave (siendo la intensidad de campo requerida de 20 μv/m) con una potencia máxima de 4 kilovatios irradiada por la estación de tierra. Junio en el hemisferio septemtrional, diciembre en el hemisferio austral, equinoccio entre los 10° N y 10° S. Actividad solar 125. Sujeto a una FMU suficientemente elevada.

Los números de las curvas indican la frecuencia en Mc/s.

———— Ruido atmosférico - - - - Ruido de la aeronave

Рис. 29. Максимальная дальность действия при радиотелефонии, в полдень, ограниченная для наземной станции атмосферными помехами при пиковой мощности излучения самолета в 200 ватт или самолетными помехами (при требуемой напряженности поля в 20 мкв/м) при пиковой мощности излучения наземной станции в 4 квт. Июнь в северном полушарии, декабрь в южном полушарии, равноденствие между 10° северной и 10° южной широты. Число солнечных пятен 125. При условии достаточно высокой МПЧ. Цифры на кривых обозначают частоту в мгц.

——— Атмосферные помехи - - - Помехи на самолете

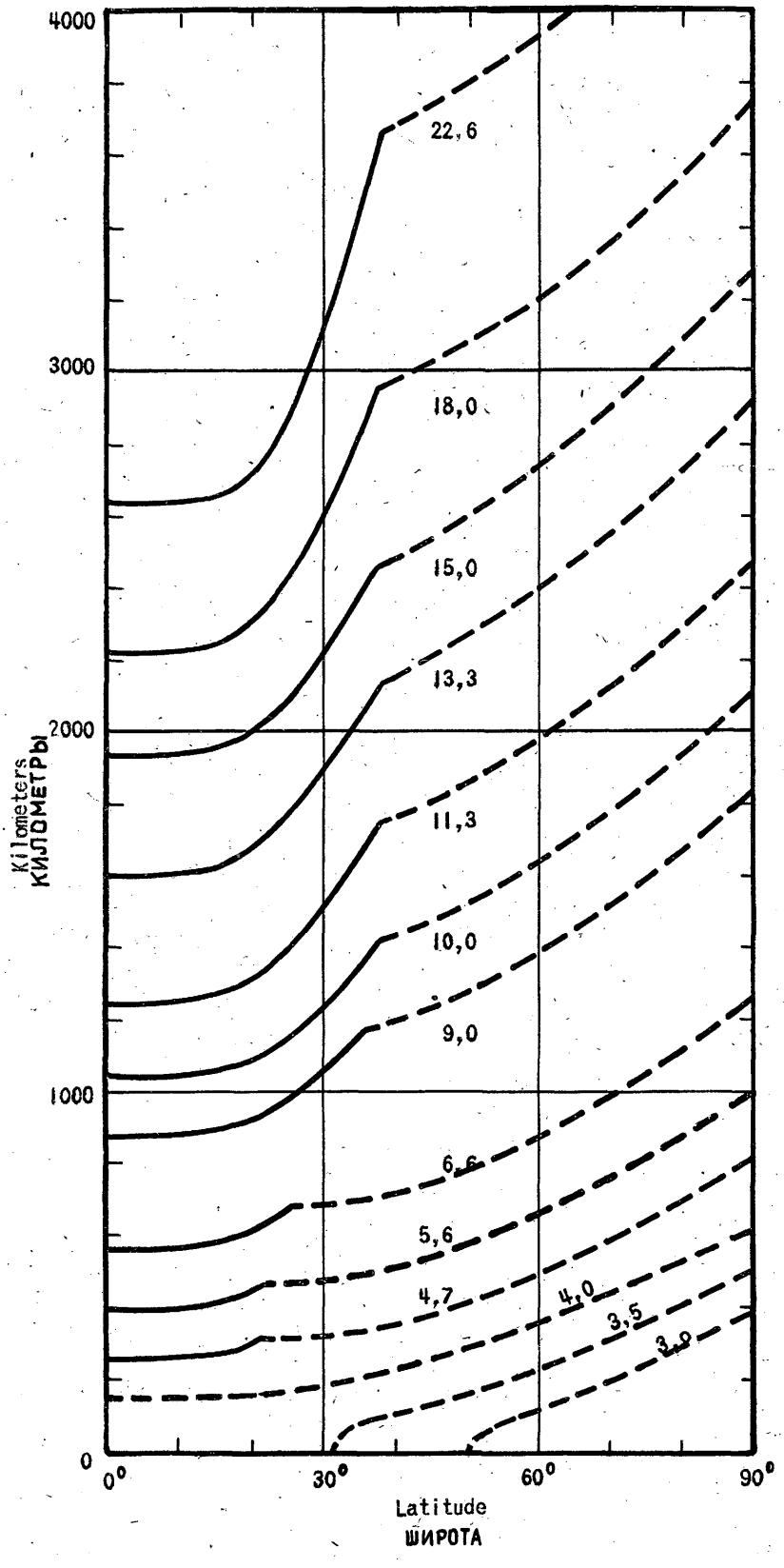

4000
3000
2000
1000
0
Kilometers
КИЛОМЕТРЫ
22,6
18,0
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 29 Рис. 29

Fig. 30. Portées maximum des communications radiotéléphoniques air-sol pendant la nuit, en présence de parasites atmosphériques, avec une puissance de crête de 200 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Les valeurs de la puissance de crête de la station terrestre, à droite de la figure, indiquent les portées correspondantes en présence uniquement de parasites d'origine locale à bord de l'aéronef.

Les chiffres figurant sur les courbes représentent des Mc/s.

Fig. 30 Maximum distance range for radiotelephone air-ground communication at night in the presence of atmospheric noise, based on 200 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. Values of ground station peak power on the right indicate corresponding ground-air ranges in the presence of local aircraft noise only.

Figures on curves are Mc/s.

Fig. 30. Alcance máximo para comunicación de aire a tierra por radiotelefonía durante la noche, en presencia de ruido atmosférico basado en una potencia máxima de 200 vatios, irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. Los valores de la potencia máxima de la estación de tierra que figuran a la derecha indican los alcances correspondientes de tierra a aire en presencia del ruido local de la aeronave, solamente.

Los números en las curvas indican la frecuencia en Mc/s.

Рис. 30. Максимальная дальность действия для радиотелефонной связи, "самолет-земля", ночью, осуществляемая самолетом, излучающим пиковую мощность в 200 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. Значения пиковой мощности наземной станции (справа) обозначает соответственную дальность действия связи "земля-самолет", при наличии только местных помех на самолете. Цифрн на кривых обозначают частоту в мгц.

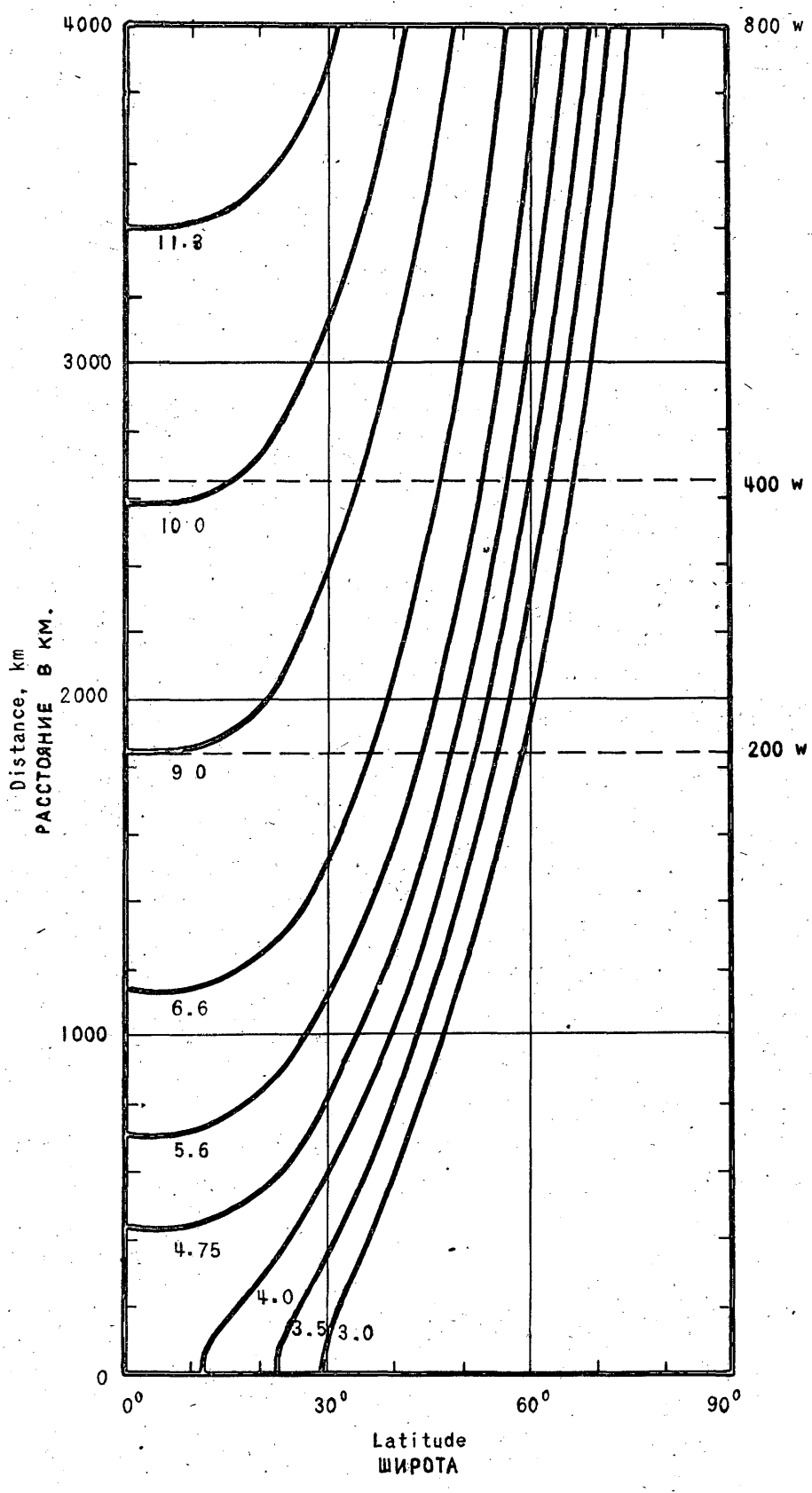

4000
3000
2000
1000
0
800 w
400 w
200 w
11.8
10 0
9 0
6.6
5.6
4.75
4.0
3.5
3.0
0°
30°
60°
90°
Latitude
ШИРОТА
Distance, km
РАССТОЯНИЕ В КМ.

Fig. 30 Рис. 30

Fig. 31. Portées maximum des communications radiotéléphoniques air-sol en présence de parasites atmosphériques, avec une puissance de crête de 200 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station terrestre 20.00. Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (pour les stations au nord de 30° N et au sud de 30° S avec un degré de parasites 3 ou moins, en hiver seulement). Les valeurs de la puissance de crête rayonnée par la station terrestre, dans le haut de la figure, indiquent les portées correspondantes en présence uniquement de parasites d'origine locale à bord de l'aéronef.

Fig. 31. Maximum distance range for radiotelephone air-ground communication in the presence of atmospheric noise, based on 200 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 2000 local time at the ground station. Numbers on curves indicate noise grade at the ground station (winter only for stations north of 30° N and south of 30° S with noise grade 3 or less). Values of ground station peak radiated power at top indicate corresponding ground-air ranges in the presence of local aircraft noise only.

Fig. 31. Alcance máximo para comunicación de aire a tierra por radiotelefonía en presencia de ruido atmosférico, basado en una potencia máxima de 200 vatios irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 2000 hora local en la estación de tierra. Los números en las curvas indican el grado de ruido en la estación de tierra (para las estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido 3, o menor, invierno solamente). Los valores de la potencia máxima irradiada de la estación de tierra que figuran en la parte superior, indican los alcances correspondientes de tierra a aire en presencia de ruido local de la aeronave solamente.

Рис. 31. Максимальная дальность действия для радиотелефонной связи "самолет-земля", осуществляемая самолетом, излучающим пиковую мощность в 200 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 20ч.00м. местного времени на наземной станции. Цифры на кривых обозначают пояс помех на наземной станции (зимой только для станций севернее 30° северной и южнее 30° южной широты, в поясе помех 3 или менее). Значения пиковой мощности наземной станции указанные на верху обозначают соответственную дальность действия связи "земля-самолет", при наличии на самолете только местных помех.

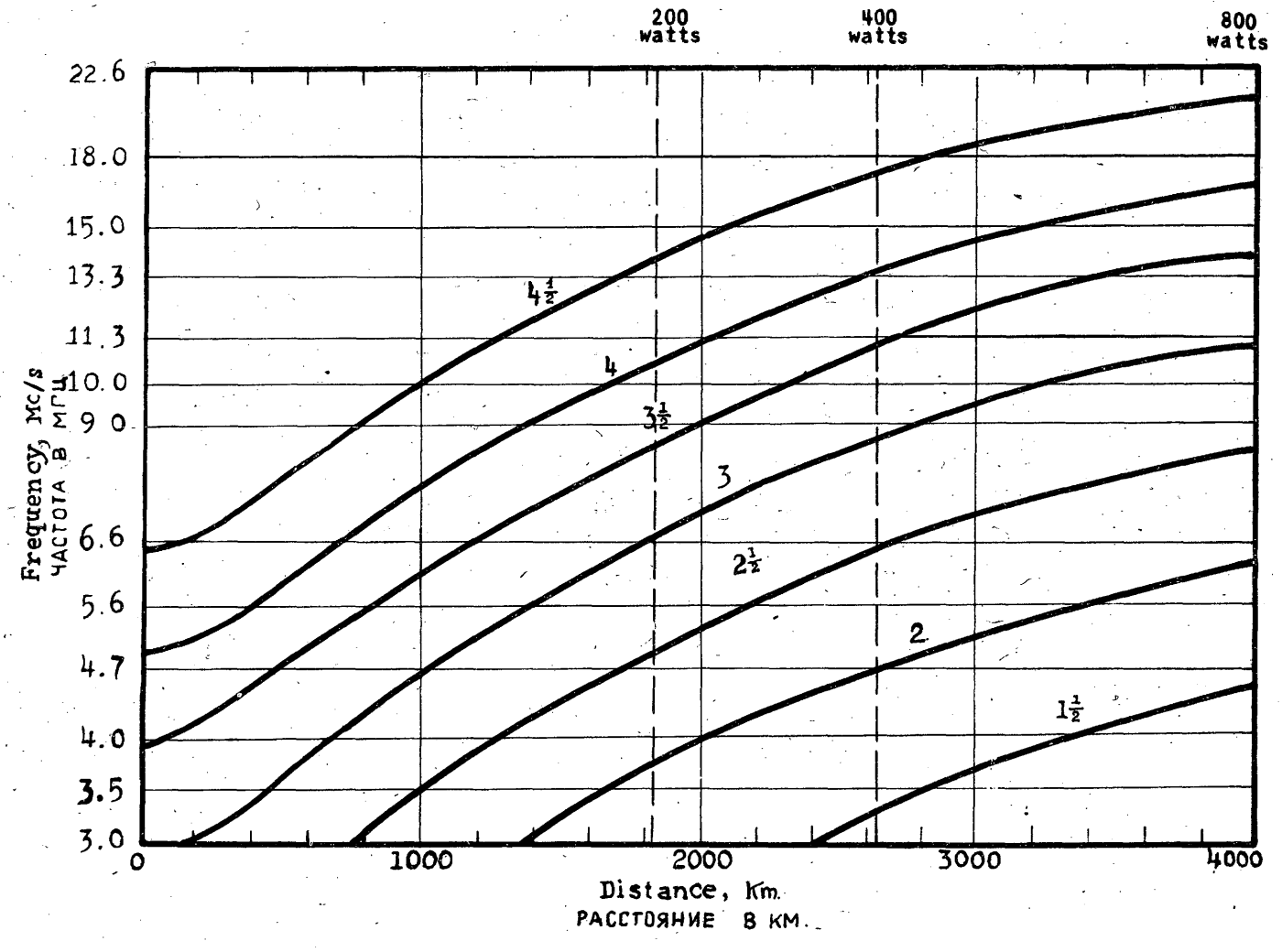

200 watts
400 watts
800 watts
22.6
18.0
15.0
13.3
11.3
10.0
9 0
6.6
5.6
4.7
4.0
3.5
3.0
Frequency, Mc/s
ЧАСТОТА В МГЦ
4½
4
3½
3
2½
2
1½
0
1000
2000
3000
4000
Distance, Km.
РАССТОЯНИЕ В КМ.

Fig. 31 Рис. 31

Fig. 32. Portées maximum des communications radiotéléphoniques air-sol, en présence de parasites atmosphériques, avec une puissance de crête de 200 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station au sol 00.00. Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (pour les stations au nord de 30° N et au sud de 30° S avec un degré de parasites de 3 ou moins, en hiver seulement). Les valeurs de la puissance de crête rayonnée par la station terrestre, dans le haut de la figure indiquent les portées correspondantes en présence uniquement de parasites d'origine locale à bord de l'aéronef.

Fig. 32. Maximum distance range for radiotelephone air-ground communication in the presence of atmospheric noise, based on 200 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 0000 local time at the ground station. Number on curves indicate noise grade at the ground station (winter only for stations north of 30° N and south of 30° S with noise grade 3 or less). Values of ground station peak radiated power at top indicate corresponding ground-air ranges in the presence of local aircraft noise only.

Fig. 32. Alcance máximo para comunicación de aire a tierra por radiotelefonía en presencia de ruido atmosférico, basado en una potencia máxima de 200 vatios irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 0000 hora local en la estación de tierra. Los números en las curvas indican el grado de ruido en la estación de tierra (para las estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido 3, o menor, invierno solamente). Los valores de la potencia máxima irradiada de la estación de tierra situados en la parte superior, indican los alcances de tierra a aire correspondientes, en presencia de ruido local de la aeronave, solamente.

Рис. 32. Максимальная дальность действия для радиотелефонной связи "самолет-земля", осуществляемая самолетом, излучающим пиковую мощность в 200 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 00ч. 00м. местного времени на наземной станции. Цифрн на кривых обозначают зону помех на наземной станции (зимой только для станций севернее 30° северной и южнее 30° южной широты в поясе помех 3 или менее). Значения пиковой мощности наземной станции указанные наверху обозначают соответственную дальность действия связи "земля-самолет", при наличии на самолете только местных помех.

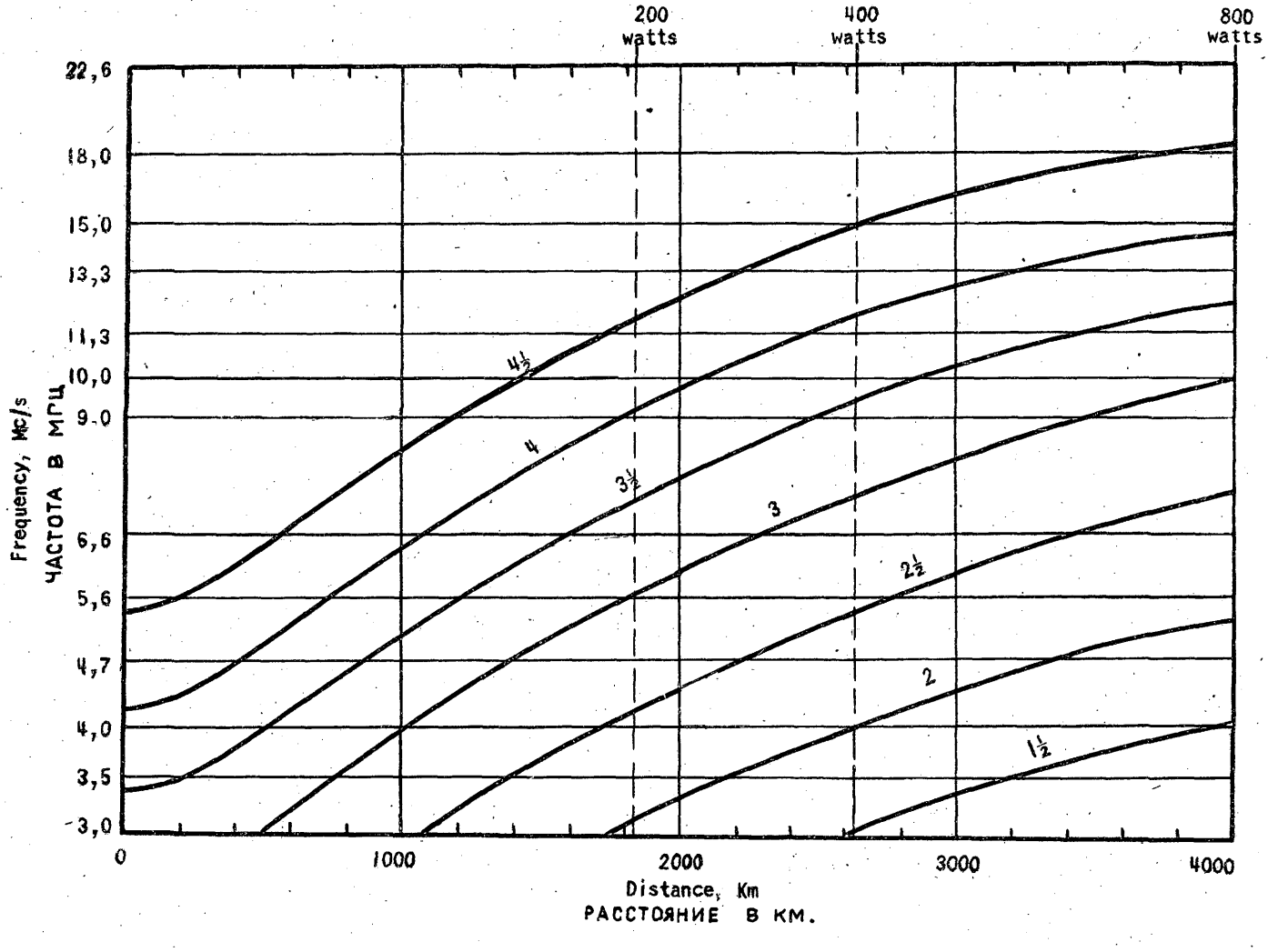

200
watts
400
watts
800
watts
22,6
18,0
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
Frequency, Mc/s
ЧАСТОТА В МГЦ
4½
4
3½
3
2½
2
1½
0
1000
2000
3000
4000
Distance, Km
РАССТОЯНИЕ В КМ.

Fig. 32 Рис. 32

Fig. 33. Portées maximum des communications radiotéléphoniques air-sol en présence de parasites atmosphériques, avec une puissance de crête de 200 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station du sol: 04.00 Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (en hiver seulement, pour des stations au nord de 30° N et au sud de 30° S avec un degré de parasites de 3 ou moins). Les valeurs de la puissance de crête rayonnée par la station terrestre, dans le haut de la figure indiquent les portées correspondantes en présence uniquement de parasites d'origine locale à bord de l'aéronef.

Fig. 33. Maximum distance range for radiotelephone air-ground communication in the presence of atmospheric noise, based on 200 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 0400 local time at the ground station. Numbers on curves indicate noise grade at the ground station (winter only for stations north of 30° N and south of 30° S with noise grade 3 or less). Values of ground station peak radiated power at top indicate corresponding ground-air ranges in the presence of local aircraft noise only.

Fig. 33. Alcance máximo para comunicación de aire a tierra por radiotelefonía en presencia de ruido atmosférico, basado en una potencia máxima de 200 vatios irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 0400 hora local en la estación de tierra. Los números en las curvas indican el grado de ruido en la estación de tierra (para las estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido de 3, o menor, invierno solamente). Los valores de la potencia máxima irradiada de la estación de tierra que figuran en la parte superior, indican los alcances de tierra a aire correspondientes en presencia de ruido local de la aeronave solamente.

Рис. 33. Максимальная дальность действия для радиотелефонной связи "самолет-земля", осуществляемая самолетом, излучающим пиковую мощность в 200 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 04ч. 00м. местного времени на наземной станции. Цифры на кривых обозначают пояс помех на наземной станции (зимой только для станций севернее 30° северной широты и южнее 30° южной широты, в поясе помех 3 или менее). Значения пиковой мощности наземной станции указанные наверху обозначают соответственную дальность действия "земля-самолет" при наличии на самолете только местных помех.

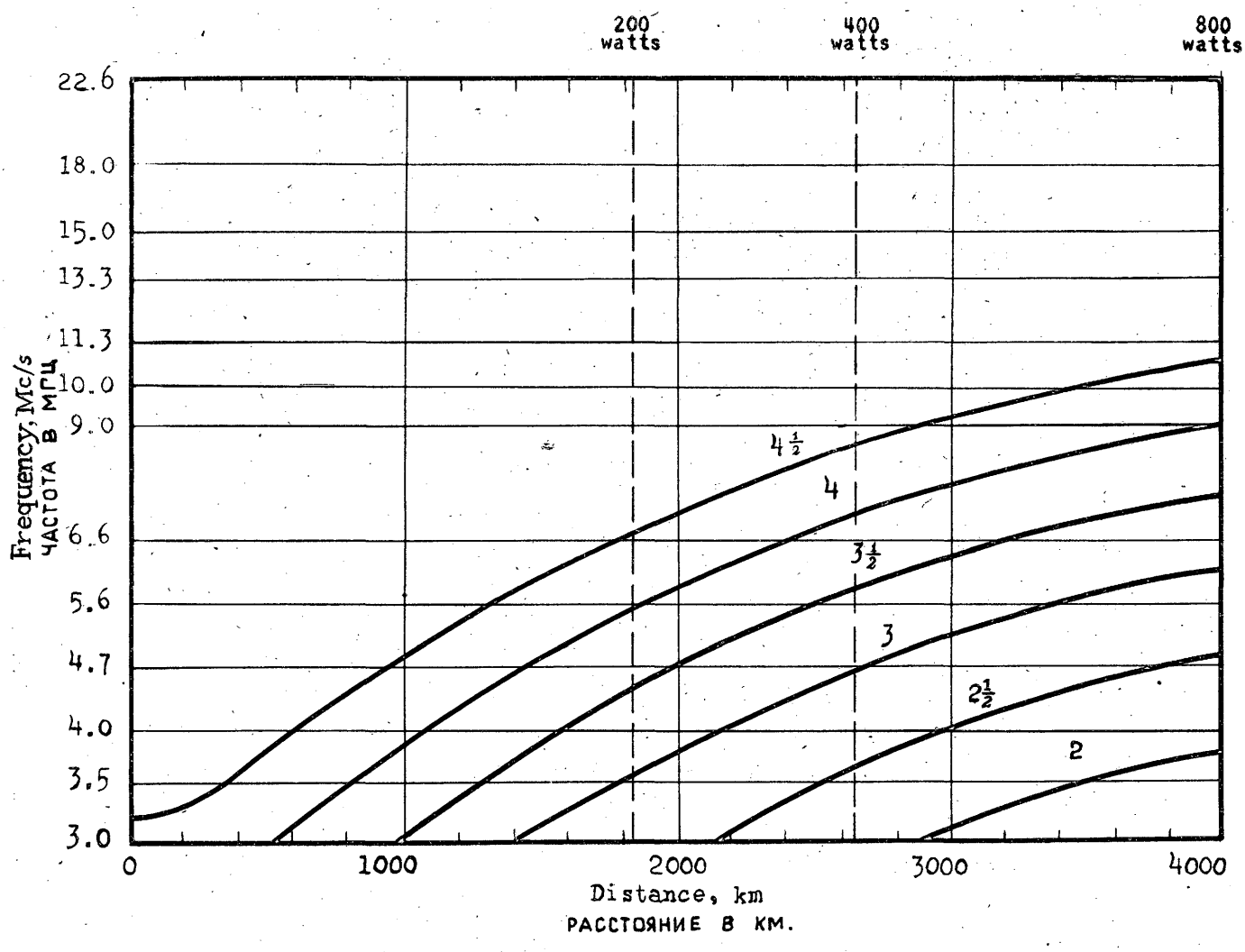

200 watts
400 watts
800 watts
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
Frequency, Mc/s
ЧАСТОТА В МГЦ
4½
4
3½
3
2½
2
0
1000
2000
3000
4000
Distance, km
РАССТОЯНИЕ В КМ.

Fig. 33 Рис. 33

Fig. 34. Portées maximum à midi en radiotélégraphie (manuelle), limitée par les parasites atmosphériques à la station terrestre, avec une puissance de crête de 50 watts rayonnée par l'aéronef; ou limitée par les parasites d'origine locale à bord de l'aéronef (intensité du champ nécessaire : 5 μv/m) avec une puissance de crête de 1 kW rayonnée par la station terrestre. Juin pour l'hémisphère nord, décembre pour l'hémisphère sud, équinoxe entre 10°N et 10°S. Activité solaire 0. Portée conditionnée par des FMU suffisamment hautes. Les chiffres figurant sur les courbes représentent des Mc/s.

——— parasites atmosphériques - - - - parasites d'origine locale.

Fig. 34. Maximum distance range for radiotelegraph (manual) at noon as limited by atmospheric noise at the ground station with 50 watts peak power radiated by the aircraft, or by aircraft noise (5 μv/m required field intensity) with 1 kW peak power radiated by the ground station. June in the northern hemisphere, December in the southern hemisphere, equinox between 10°N and 10°S. Sunspot number 0. Subject to sufficiently high MUF. Figures on curves are Mc/s.

——— Atmospheric noise - - - - Aircraft noise.

Fig. 34. Alcance máximo para radiotelegrafía (manual) a mediodía, limitado por el ruido atmosférico en la estación de tierra con una potencia máxima de 50 vatios irradiada por la aeronave, o por el ruido de la aeronave, (siendo la intensidad de campo requerida de 5 μv/m) con une potencia máxima de 1 kilovatio, irradiada por la estación de tierra. Junio en el hemisferio septentrional, diciembre en el hemisferio austral, equinoccio entre los 10°N y los 10°S. Actividad solar 0. Sujeto a una FMU suficientemente elevada. Los números en las curvas indican la frecuencia en Mc/s.

——— Ruido atmosférico - - - - Ruido de la aeronave.

Рис. 34. Максимальная дальность действия для радиотелеграфии (ручной), в полдень, ограниченная на наземной станции атмосферными помехами при пиковой мощности в 50 ватт, излучаемой самолетом, или помехами на самолете (при требуемой напряженности поля в 5 мкв/м) при пиковой мощности в 1 кв, излучаемой наземной станцией. Июнь в северном полушарии, декабрь в южном полушарии, равноденствие между 10° северной и 10° южной широты. Число солнечных пятен 0, при условии достаточно высокой МПЧ. Цифры на кривых обозначают мгц.

——— Атмосферные помехи - - - - Помехи на самолете

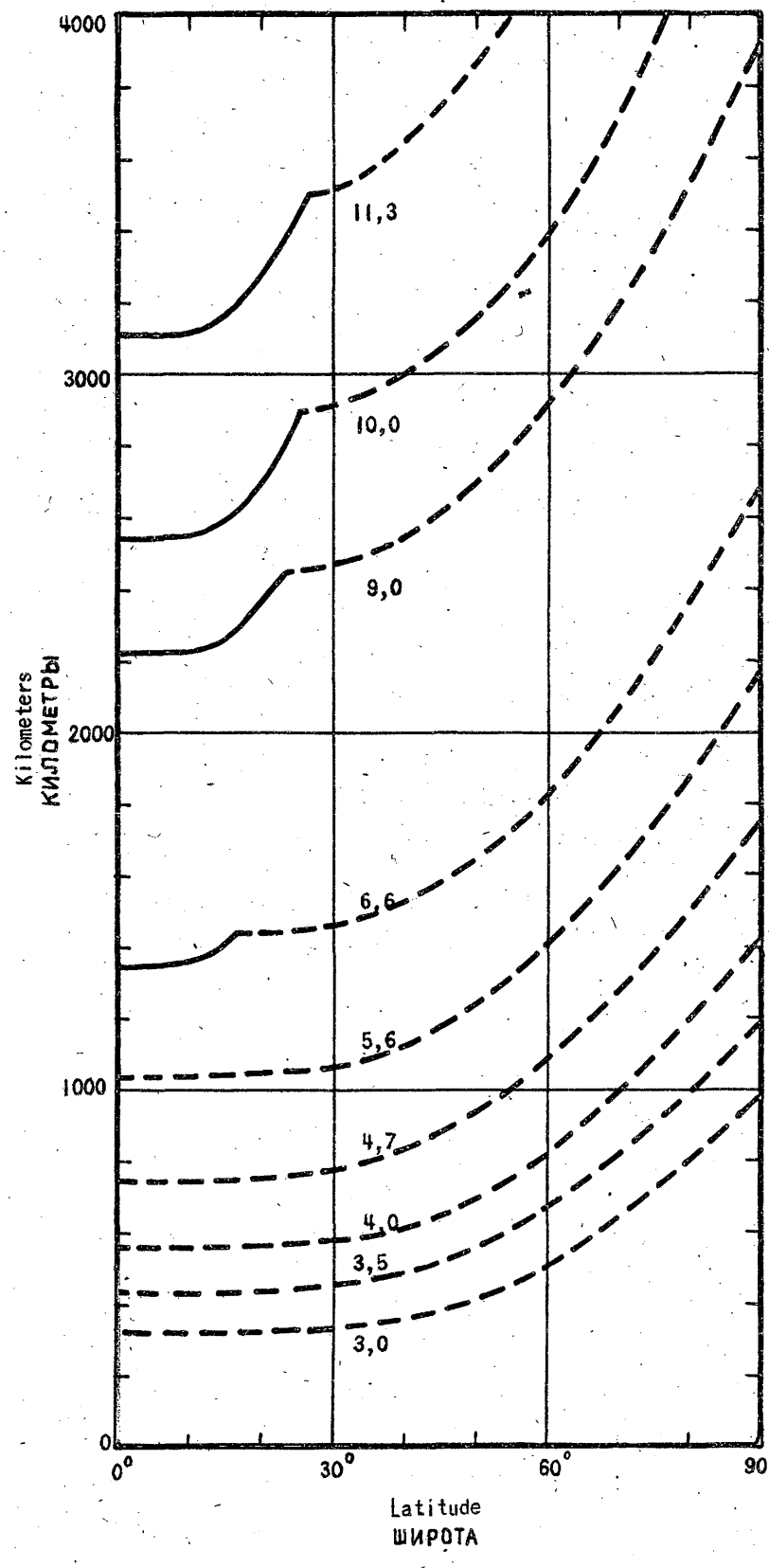

4000
3000
2000
1000
0
Kilometers
КИЛОМЕТРЫ
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 34 Рис. 34

Fig. 35. Portées maximum à midi en radiotélégraphie (manuelle), limitée par les parasites atmosphériques à la station terrestre avec une puissance de crête de 50 watts rayonnée par l'aéronef; ou limitée par les parasites d'origine locale à bord de l'aéronef (intensité du champ nécessaire : 5 μv/m) avec une puissance de crête de 1 kW rayonnée par la station terrestre. Juin pour l'hémisphère nord, décembre pour l'hémisphère sud, équinoxe entre 10°N et 10°S. Activité solaire 125. Portée conditionnée par des FMU suffisamment hautes. Les chiffres figurant sur les courbes représentent des Mc/s.

———— parasites atmosphériques - - - - parasites d'origine locale.

Fig. 35. Maximum distance range for radiotelegraph (manual) at noon as limited by atmospheric noise at the ground station with 50 watts peak power radiated by the aircraft, or by aircraft noise (5 μv/m required field intensity) with 1 kW peak power radiated by the ground station. June in the northern hemisphere, December in the southern hemisphere, equinox between 10°N and 10°S. Sunspot number 125. Subject to sufficiently high MUF. Figures on curves are Mc/s.

———— Atmospheric noise - - - - Aircraft noise.

Fig. 35. Alcance máximo para radiotelegrafía (manual) a mediodía, limitado por ruido atmosférico en la estación de tierra, con una potencia máxima de 50 vatios irradiada por la aeronave, o por el ruido de la aeronave (siendo la intensidad de campo requerida de 5 μv/m) con una potencia máxima de 1 kilovatio irradiada por la estación de tierra. Junio en el hemisferio septentrional, diciembre en el hemisferio austral, equinoccio entre los 10°N y los 10°S. Actividad solar 125. Sujeto a una FMU suficientemente elevada. Los números en las curvas indican la frecuencia en Mc/s.

———— Ruido atmosférico - - - - Ruido de la aeronave.

Рис.35. Максимальная дальность действия для радиотелеграфии (ручной) в полдень, ограниченная на наземной станции атмосферными помехами при пиковой мощности в 50 ватт, излучаемой самолетом или помехами на самолете (при требуемой напряженности поля в 5 мкв/м) при пиковой мощности в 1 кв излучаемой наземной станцией. Июнь в северном полушарии, декабрь в южном полушарии. Равноденствие между 10° северной и 10° южной широты. Число солнечных пятен 125. При условии достаточно высокой МПЧ. Цифры на кривых обозначают мгц.

———— Атмосферные помехи - - - - Помехи на самолете

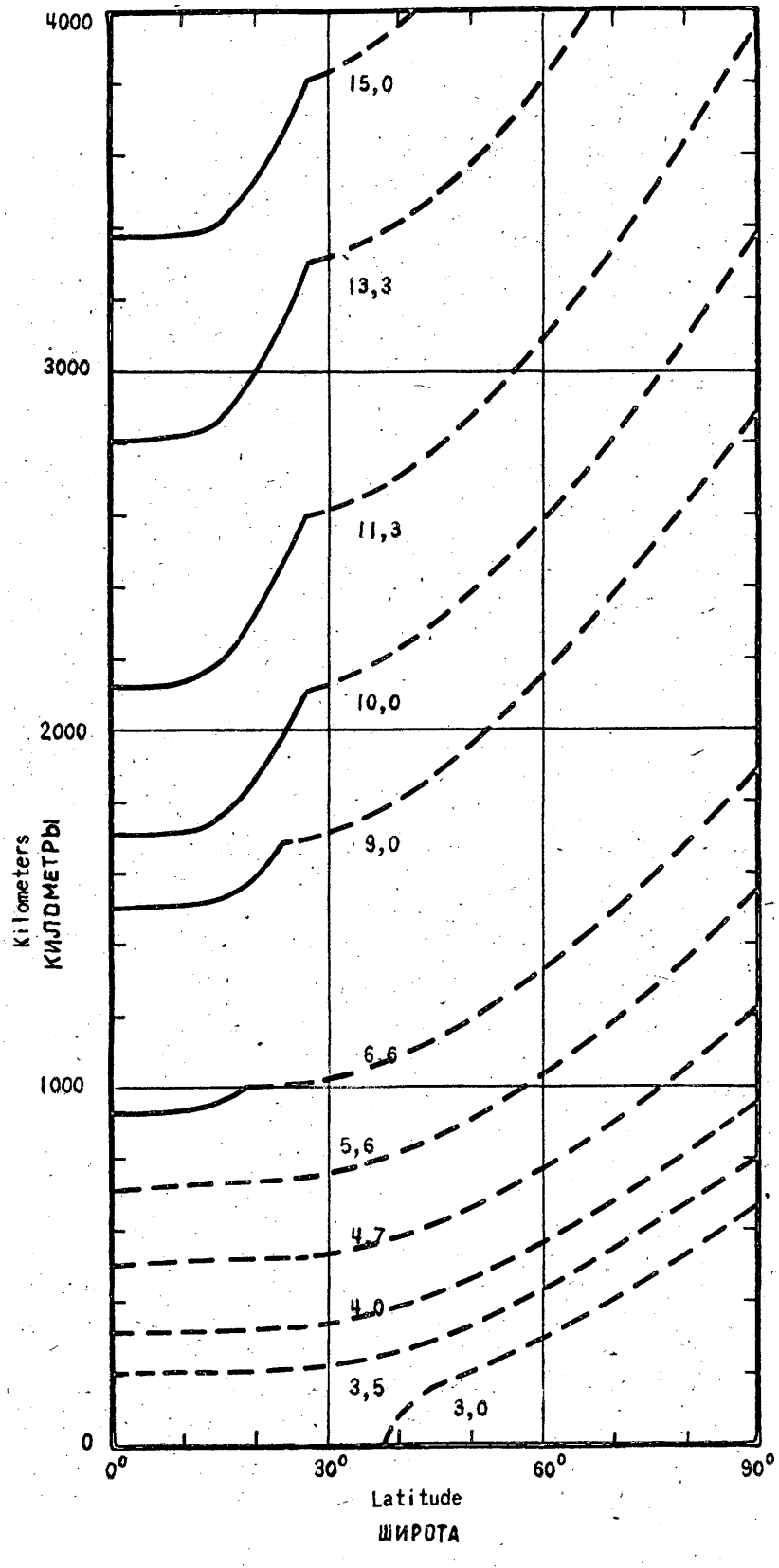

4000
3000
2000
1000
0
Kilometers
КИЛОМЕТРЫ
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 35 Рис. 35

Fig. 36. Portées maximum en radiotélégraphie (manuelle) des communications air-sol pendant la nuit en présence de parasites atmosphériques avec une puissance de crête de 50 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. La portée sol-air pour une intensité de champ nécessaire de 5 µv/m est supérieure à 4000 km pour une puissance de 50 watts ou davantage, rayonnée par la station terrestre. Les chiffres figurant sur les courbes représentent des Mc/s.

Fig. 36. Maximum distance range for radiotelegraph (manual) air-ground communication at night in the presence of atmospheric noise, based on 50 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. Ground-air range for 5 µv/m required field intensity is greater than 4000 km for 50 watts or more peak power radiated by the ground station. Figures on curves are Mc/s.

Fig. 36. Alcance máximo para comunicación de aire a tierra por radiotelegrafía (manual), por la noche, en presencia de ruido atmosférico, con base en una potencia máxima de 50 vatios, irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. El alcance de tierra a aire para la intensidad de campo requerida de 5 µv/m es superior a 4000 km. para una potencia máxima, irradiada por la estación de tierra de 50 vatios o mas. Los números en las curvas indican la frecuencia en Mc/s.

Рис. 36. Максимальная дальность действия для радиотелеграфной (ручной) связи "самолет-земля", ночью, осуществляемая самолетом, излучающим пиковую мощность в 50 ватт, при условии достаточно высокой МПЧ. Дальность действия связи "земля-самолет" для требуемой напряженности поля в 5 мкв/м и пиковой мощности в 50 или более ватт, излучаемой наземной станцией, превышает 4000 км. Цифры на кривых обозначают мгц.

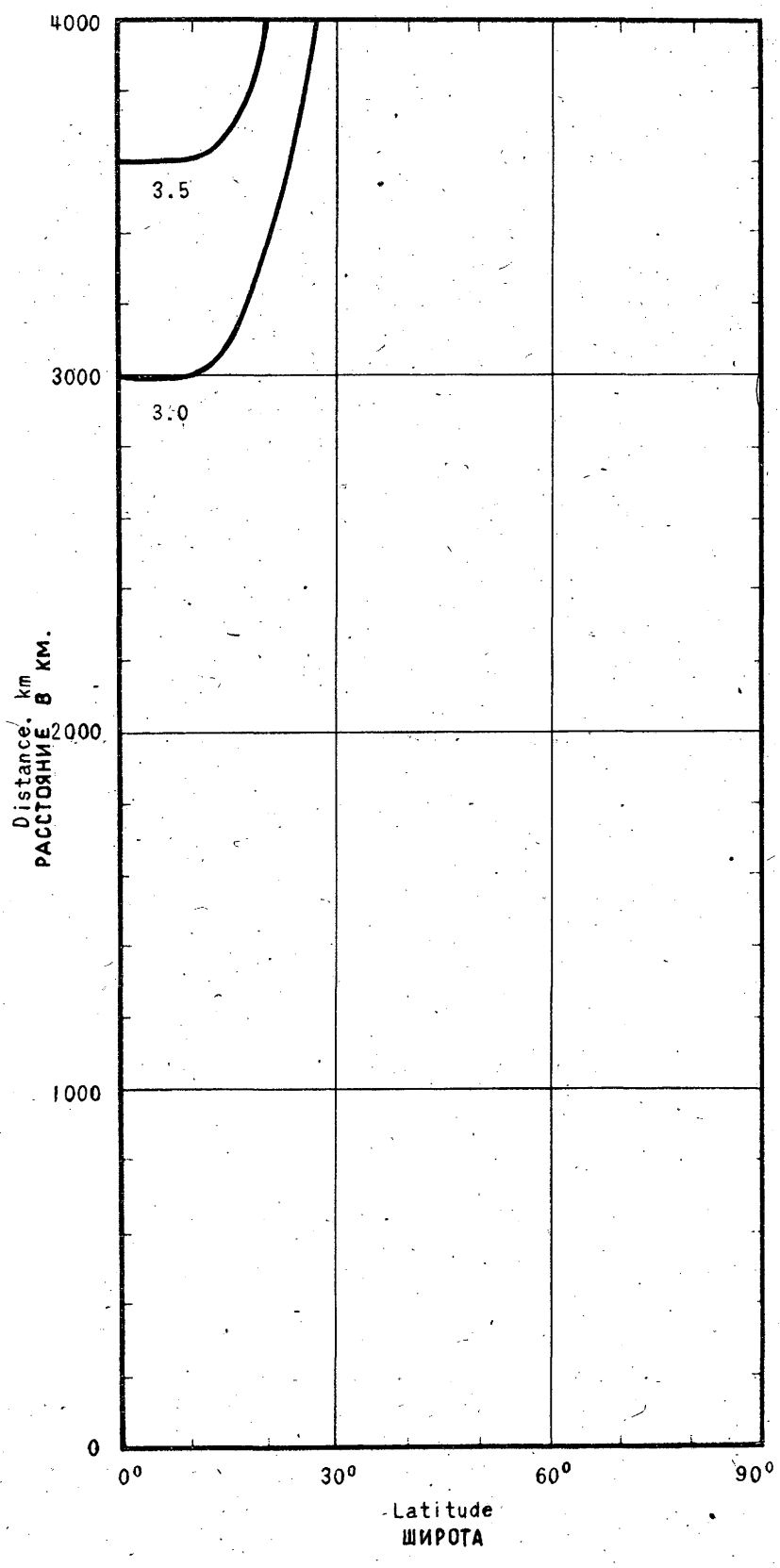

4000
3000
2000
1000
0
3.5
3.0
Distance, km
РАССТОЯНИЕ В КМ.
0°
30°
60°
90°
Latitude
ШИРОТА

Fig. 36 Рис. 36

Fig. 37. Portées maximum en radiotélégraphie (manuelle) des communications air-sol en présence de parasites atmosphériques avec une puissance de crête de 50 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station au sol: 20.00. Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (pour les stations au nord de 30 N et au sud de 30 S avec un degré de parasites de 3 ou moins, en hiver seulement). La portée sol-air, pour une intensité de champ nécessaire de 5 µv/m, est suppérieure à 4000 km, pour une puissance de crête de 50 watts ou davantage, rayonnée par la station terrestre.

Fig. 37. Maximum distance range for radiotelegraph (manual) air-ground communication in the presence of atmospheric noise, based on 50 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 2000 local time at the ground station. Numbers on curves indicate noise grade at the ground station (winter only for stations north of 30 N and south of 30 S with noise grade 3 or less). Ground-air range for 5 µv/m required field intensity is greater than 4000 km for 50 watts or more peak power radiated by the ground station.

Fig. 37. Alcance máximo para comunicación de aire a tierra por radiotelegrafía (manual), en presencia de ruido atmosférico, basado en una potencia máxima de 50 vatios, irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 2000 hora local en la estacion de tierra. Los números en las curvas indican el grado de ruido en la estación de tierra (para las estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido 3 o menor invierno solamente). El alcance de aire a tierra para la intensidad de campo requerida de 5 µv/m es superior a 4000 km. para una potencia máxima, irradiada por la estación de tierra de 50 vatios o mas. Los números en las curvas indican la frecuencia en Mc/s.

Рис. 37. Максимальная дальность действия для радиотелеграфной (ручной) связи "самолет-земля", осуществляемая самолетом с пиковой мощностью в 50 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 20ч.00м. местного времени на наземной станции. Цифры на кривых обозначают пояс помех на наземной станции (зимой только для станций севернее 30° северной и южнее 30° южной широты в поясе помех 3 или менее). Дальность действия связи "земля-самолет" для требуемой напряженности поля в 5 мкв/м и пиковой мощности в 50 или более ватт, излучаемой станцией, превышает 4000 км.

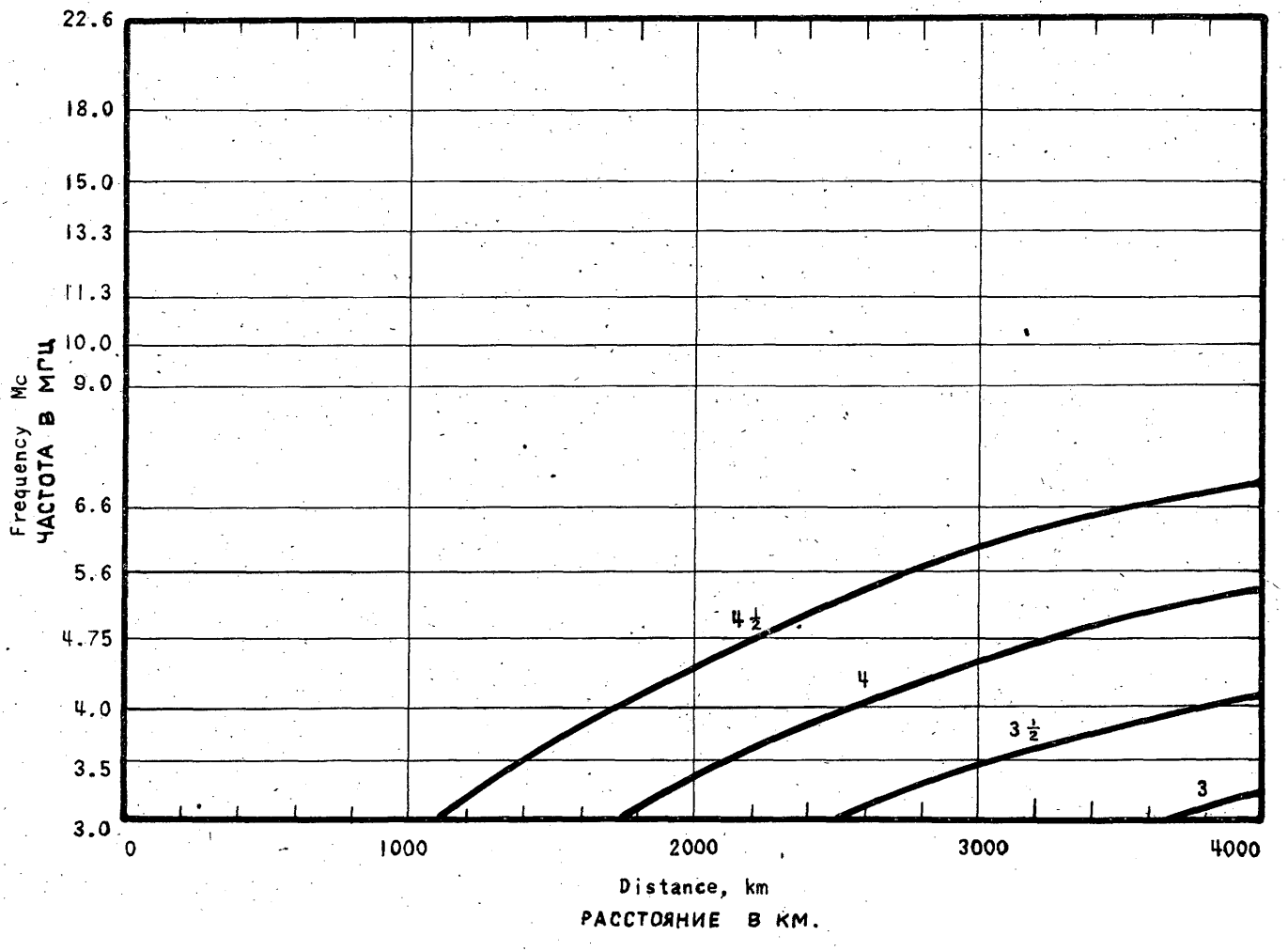

22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.75
4.0
3.5
3.0
Frequency Mc
ЧАСТОТА В МГЦ
4½
4
3½
3
0
1000
2000
3000
4000
Distance, km
РАССТОЯНИЕ В КМ.

Fig. 37 Рис. 37

Fig. 38. Portées maximum en radiotélégraphie (manuelle) des communications air-sol, en présence de parasites atmosphériques, avec une puissance de crête de 50 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station au sol: 00.00 Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (pour les stations au nord de 30° N et au sud de 30° S avec un degré de parasites de 3 ou moins en hiver seulement). La portée sol-air, pour une intensité de champ nécessaire de 5 μv/m, est supérieure à 4000 km, pour une puissance de crête de 50 watts ou davantage, rayonnée par la station terrestre.

Fig. 38. Maximum distance range for radictelegraph (manual) air-ground communication in the presence of atmospheric noise, based on 50 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 0000 local time at the ground station. Numbers of curves indicate noise grade at the ground station (winter only for stations north of 30° N and south of 30° S with noise grade 3 or less). Ground-air range for 5 μv/m with noise grade 3 or less. Ground-air range for 5 uv/m required field intensity is greater than 4000 km for 50 watts or more peak power radiated by the ground station.

Fig. 38. Alcance máximo para comunicación de aire a tierra por radiotelegrafía (manual), en presencia de ruido atmosférico, basado en una potencia máxima de 50 vatios irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 0000 hora local en la estación de tierra. Los números de las curvas indican el grado de ruido en la estación de tierra (para las estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido 3 o menor invierno solamente). El alcance de aire a tierra para la intensidad de campo requerida de 5 μv/m es superior a 4000 km. para una potencia máxima irradiada por la estación de tierra de 50 vatios o más.

Рис. 38. Максимальная дальность действия для радиотелеграфной (ручной) связи "самолет-земля", осуществляемая самолетом, излучающим пиковую мощность в 50 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 00ч.00м. местного времени на наземной станции. Цифры на кривых обозначают пояс помех на наземной станции (зимой, только для станций севернее 30° северной широты и южнее 30° южной широты, в поясе помех 3 или менее). Дальность действия связи "земля-самолет" для требуемой напряженности поля в 5 мкв/м и пиковой мощности в 50 или более ватт, излучаемой наземной станцией, превышает 4000 км.

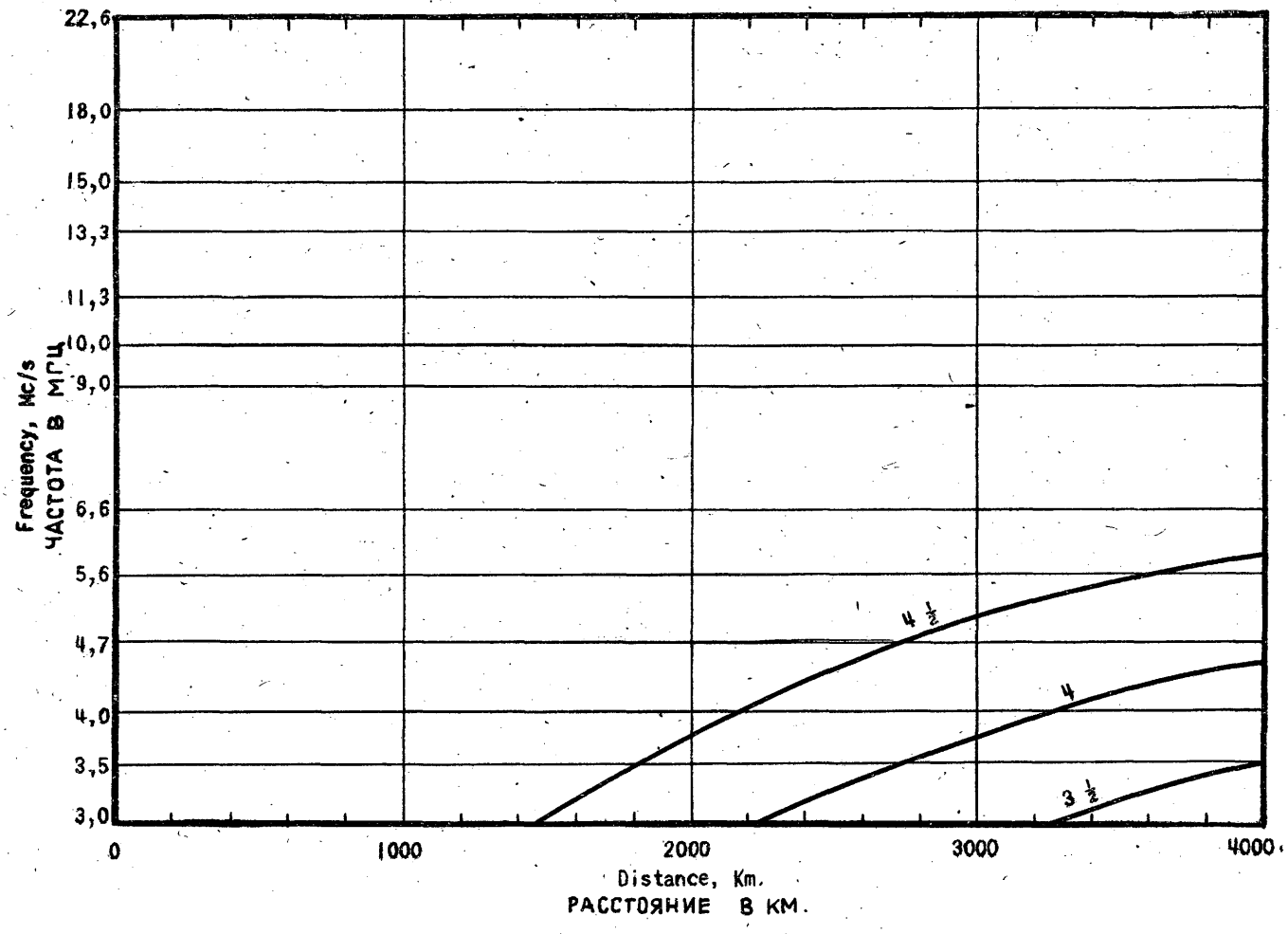

22,6
18,0
15,0
13,3
11,3
10,0
9,0
6,6
5,6
4,7
4,0
3,5
3,0
Frequency, Mc/s
ЧАСТОТА В МГЦ
4 1/2
4
3 1/2
0
1000
2000
3000
4000
Distance, Km.
РАССТОЯНИЕ В КМ.

Fig. 38 Рис. 38

Fig. 39. Portées maximum en radiotélégraphie (manuelle) des communications air-sol en présence de parasites atmosphériques, avec une puissance de crête de 50 watts, rayonnée par l'aéronef. Portée conditionnée par des FMU suffisamment hautes. Heure locale à la station du sol: 04.00. Les chiffres sur les courbes indiquent le degré des parasites à la station terrestre (pour les stations au nord de 30 ° N et au sud de 30 ° S avec un degré de parasites de 3 ou moins, en hiver seulement). La portée sol-air, pour une intensité de champ nécessaire de 5 µv/m, est supérieure à 4000 km, pour une puissance de crête de 50 watts ou davantage, rayonnée par la station terrestre.

Fig. 39. Maximum distance range for radiotelegraph (manual) air-ground communication in the presence of atmospheric noise, based on 50 watts peak power radiated by the aircraft. Subject to sufficiently high MUF. 0400 local time at the ground station. Numbers on curves indicate noise grade at the ground station (winter only for stations north of 30 N and south of 30 S with noise grade 3 or less). Ground-air range for 5 µv/m required field intensity is greater than 4000 km for 50 watts or more peak power radiated by the ground station.

Fig. 39. Alcance máximo para comunicación de aire a tierra por radiotelegrafía (manual), en presencia de ruido atmosférico, basado en una potencia máxima de 50 vatios, irradiada por la aeronave. Sujeto a una FMU suficientemente elevada. 0400 hora local en la estación de tierra. Los números en las curvas indican el grado de ruido en la estación de tierra (para les estaciones situadas al norte de los 30° N y al sur de los 30° S con un grado de ruido de 3 o menor invierno solamente) El alcance de aire a tierra de la intensidad de campo requerida de 5 µv/m es superior a 4000 km. para una potencia máxima, irradiada por la estación de tierra de 50 vatios o más.

Рис. 39. Максимальная дальность действия для радиотелеграфной (ручной) связи "самолет-земля", осуществляемая самолетом, излучающим пиковую мощность в 50 ватт, при наличии атмосферных помех, при условии достаточно высокой МПЧ. 04.00м. местного времени на наземной станции. Цифры на кривых обозначают пояс помех на наземной станции (зимой, только для станций севернее 30° северной и южнее 30° южной широты, в поясе помех 3 или менее). Дальность действия связи "земля-самолет" для требуемой напряженности поля в 5 мкв/м, при пиковой мощности в 50 или более ватт, излучаемой наземной станцией, превышает 4000 км.

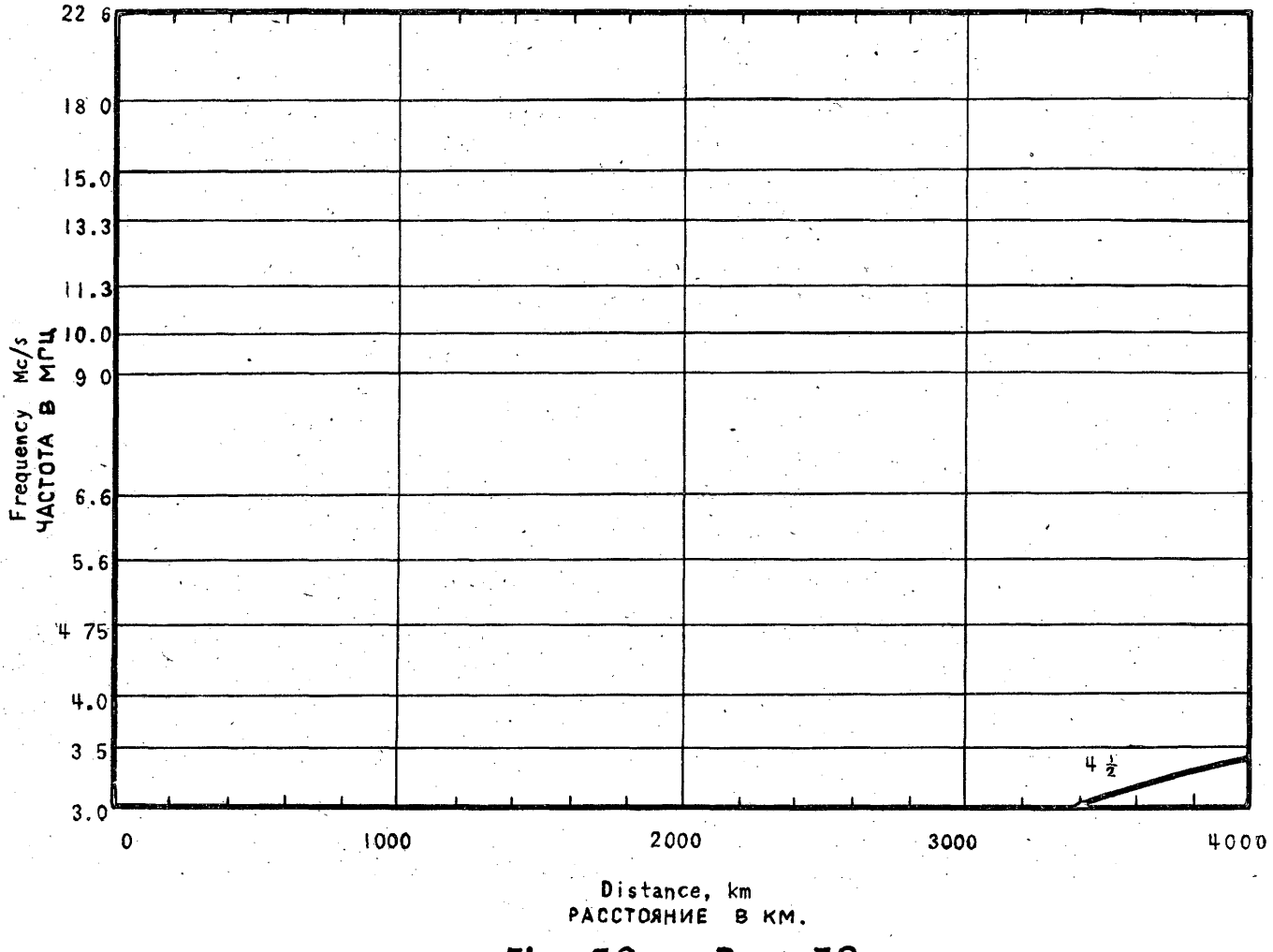

22 6
18 0
15.0
13.3
11.3
10.0
9 0
6.6
5.6
4 75
4.0
3 5
3.0
Frequency Mc/s
ЧАСТОТА В МГЦ
0
1000
2000
3000
4000
4 ½
Distance, km
РАССТОЯНИЕ В КМ.

Fig. 39 Рис. 39

Fig. 40 à 72. Portées minimum et maximum pour la radiotéléphonie, à midi.

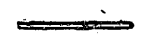
- - - - Portées minimum, 125 taches solaires
——— Portées minimum, 0 tache solaire
⊂⊃⊂⊃⊂ Portées maximum, 125 taches solaires
 Portées maximum, 0 tache solaire

Fig. 40 - 72. Combined minimum and maximum ranges for radiotelephone communication at noon.

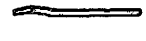
- - - - minimum range, sunspot number 125
——— minimum range, sunspot number 0
⊂⊃⊂⊃⊂ maximum range, sunspot number 125
 maximum range, sunspot number 0

Fig. 40 - 72. Alcances mínimo y máximo combinados para la comunicación por medio de radiotelefonía a mediodía.

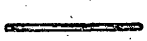
- - - - alcance mínimo, actividad solar 125
——— alcance mínimo, actividad solar 0
⊂⊃⊂⊃⊂ alcance máximo, actividad solar 125
 alcance máximo, actividad solar 0

Рис. 40 - 72. Комбинированная минимальная и максимальная дальность действия для радиотелефонной связи в полдень.

- - - минимальная дальность действия связи, число солнечных пятен 125.

——— минимальная дальность действия связи, число солнечных пятен 0.

⊂⊃⊂⊃⊂ максимальная дальность действия связи, число солнечных пятен 125.

 максимальная дальность действия связи, число солнечных пятен 0.

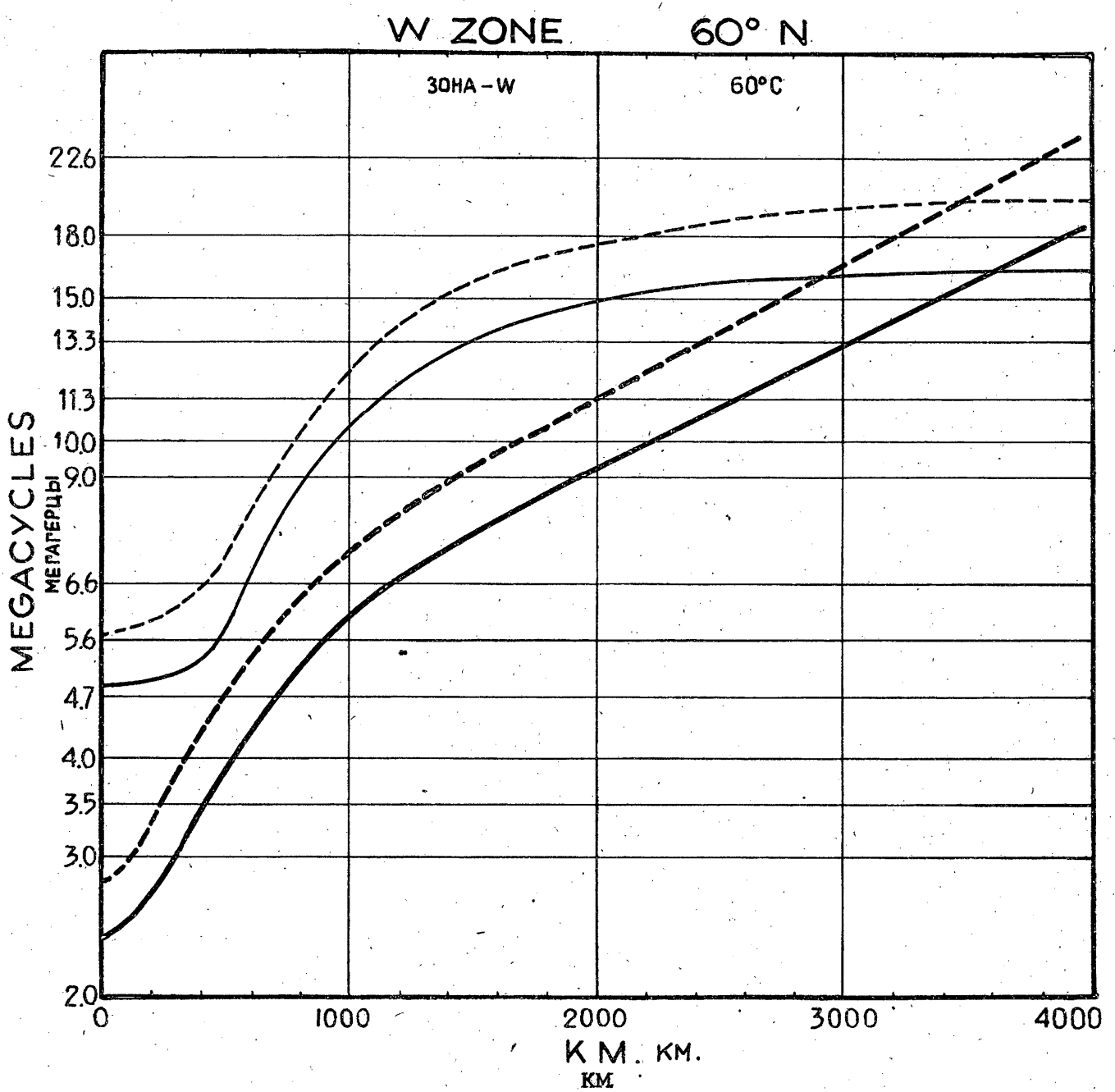

W ZONE 60° N
ЗОНА – W
60°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.
KM

Fig. 40 Рис. 40

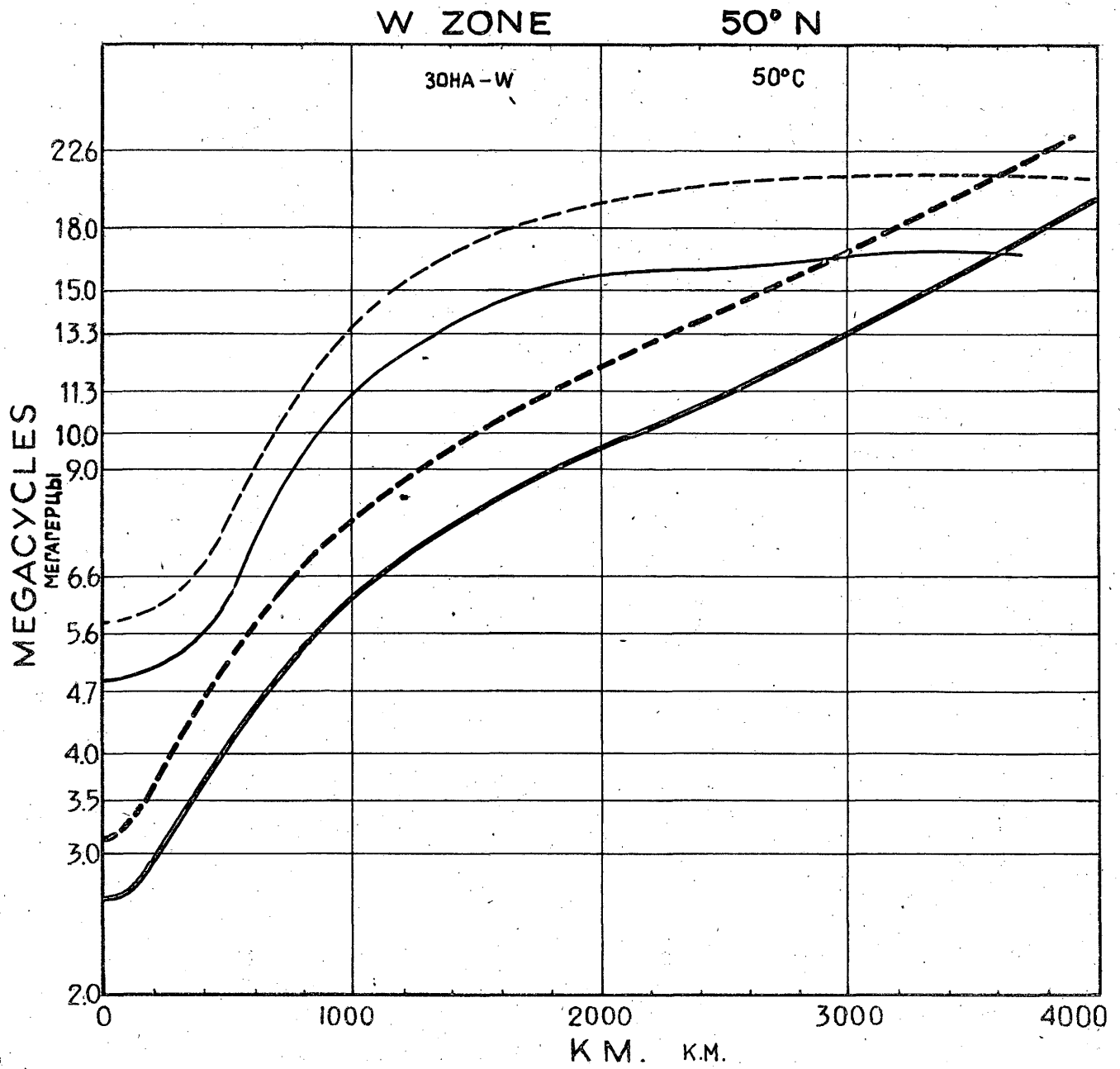

W ZONE
50° N
ЗОНА – W
50°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M.
K.M.

Fig. 41 Рис. 41

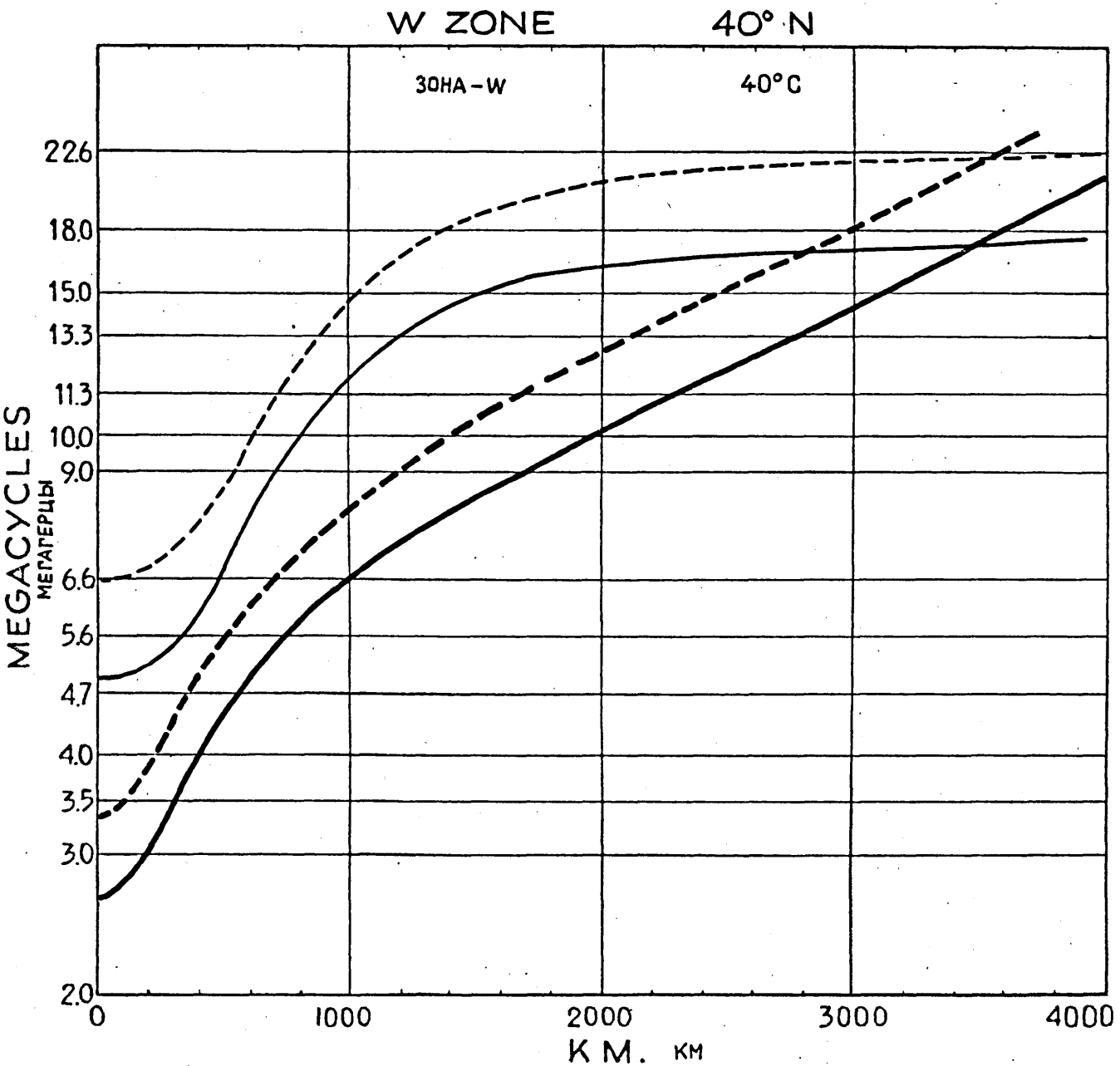

W ZONE 40° N
ЗОНА-W
40°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ

Fig. 42 Рис. 42

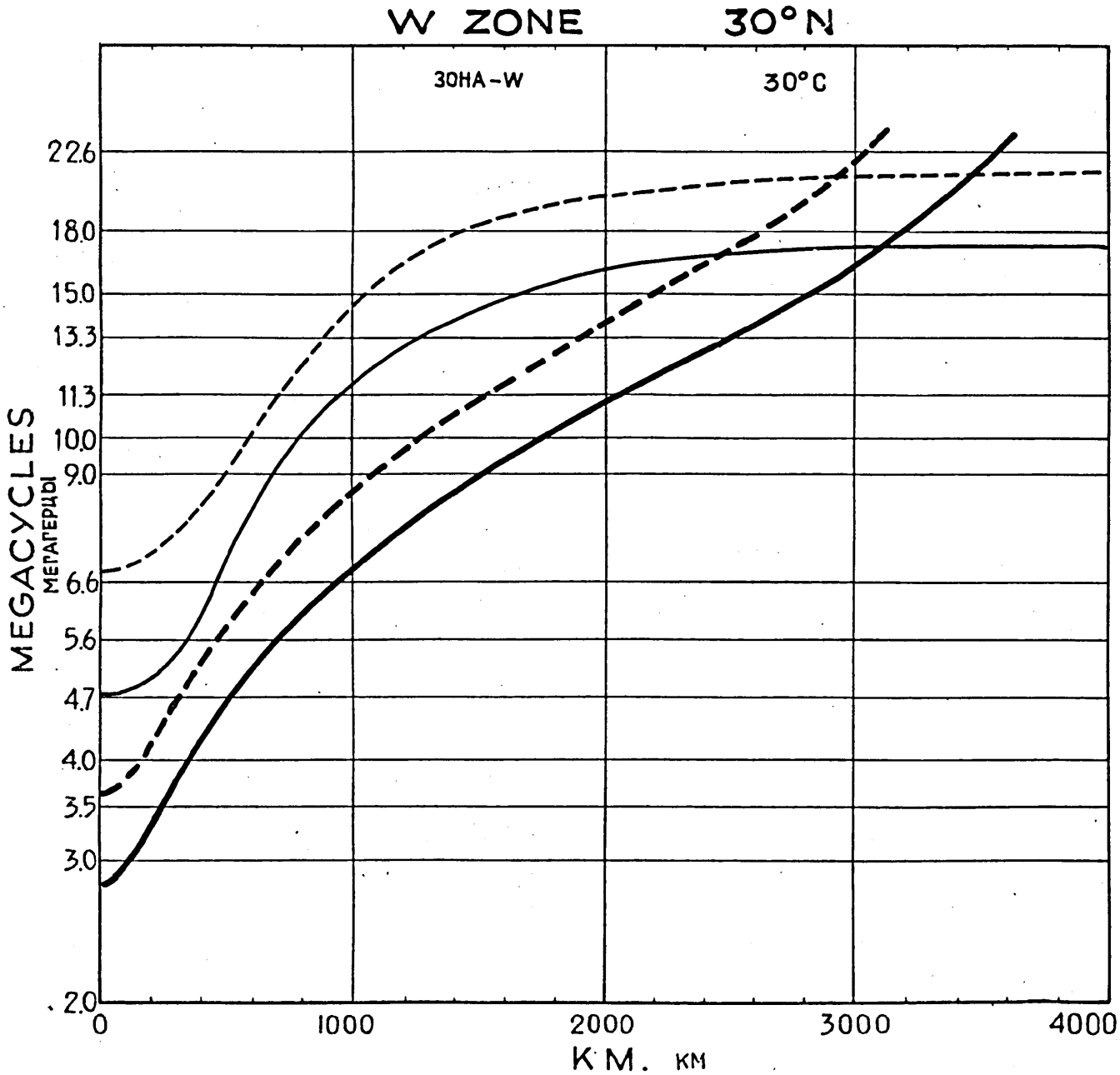

W ZONE 30°N
30HA-W
30°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ

Fig. 43 Рис. 43

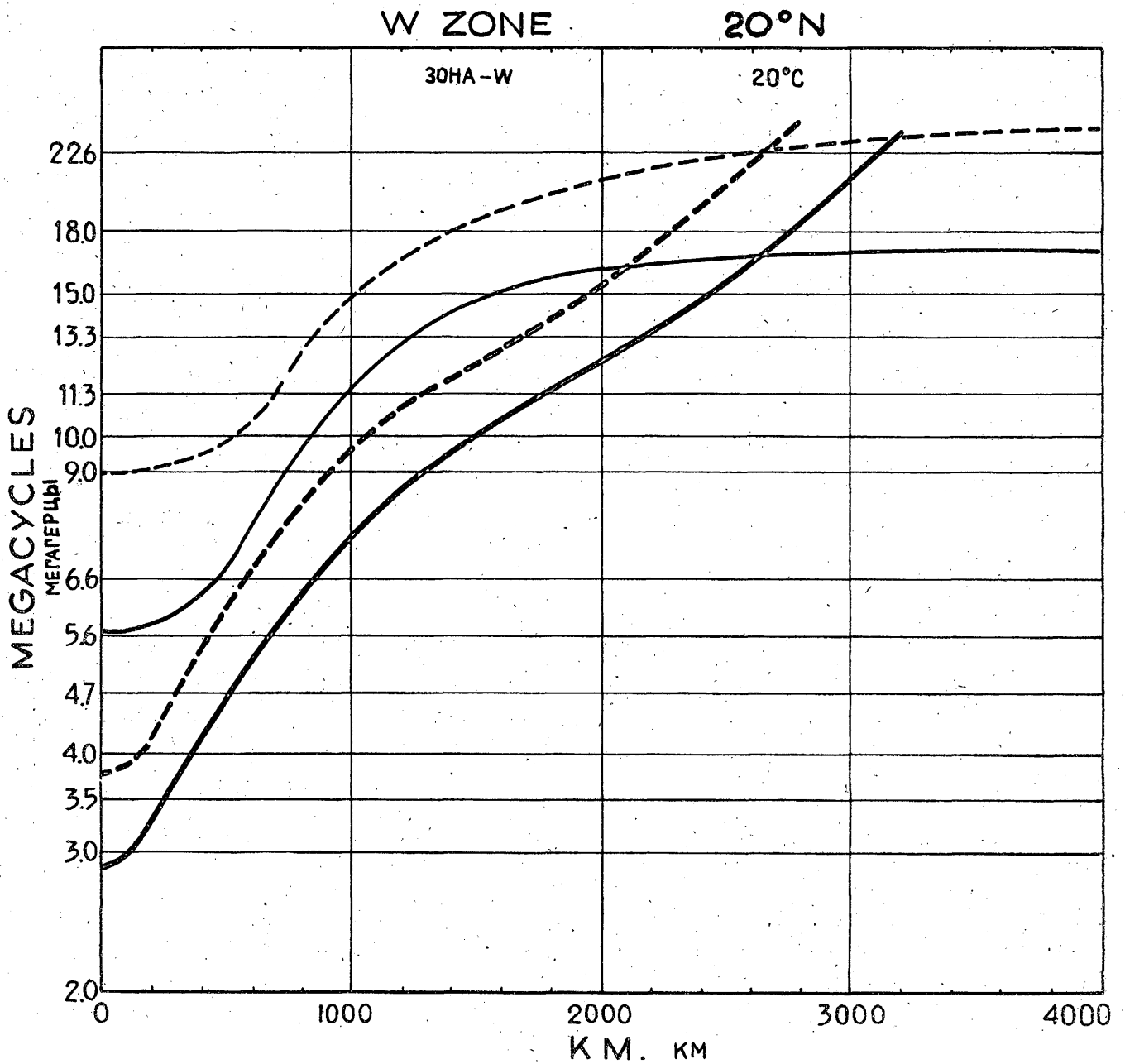

W ZONE 20°N
30HA-W
20°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
KM. КМ

Fig. 44 Рис. 44

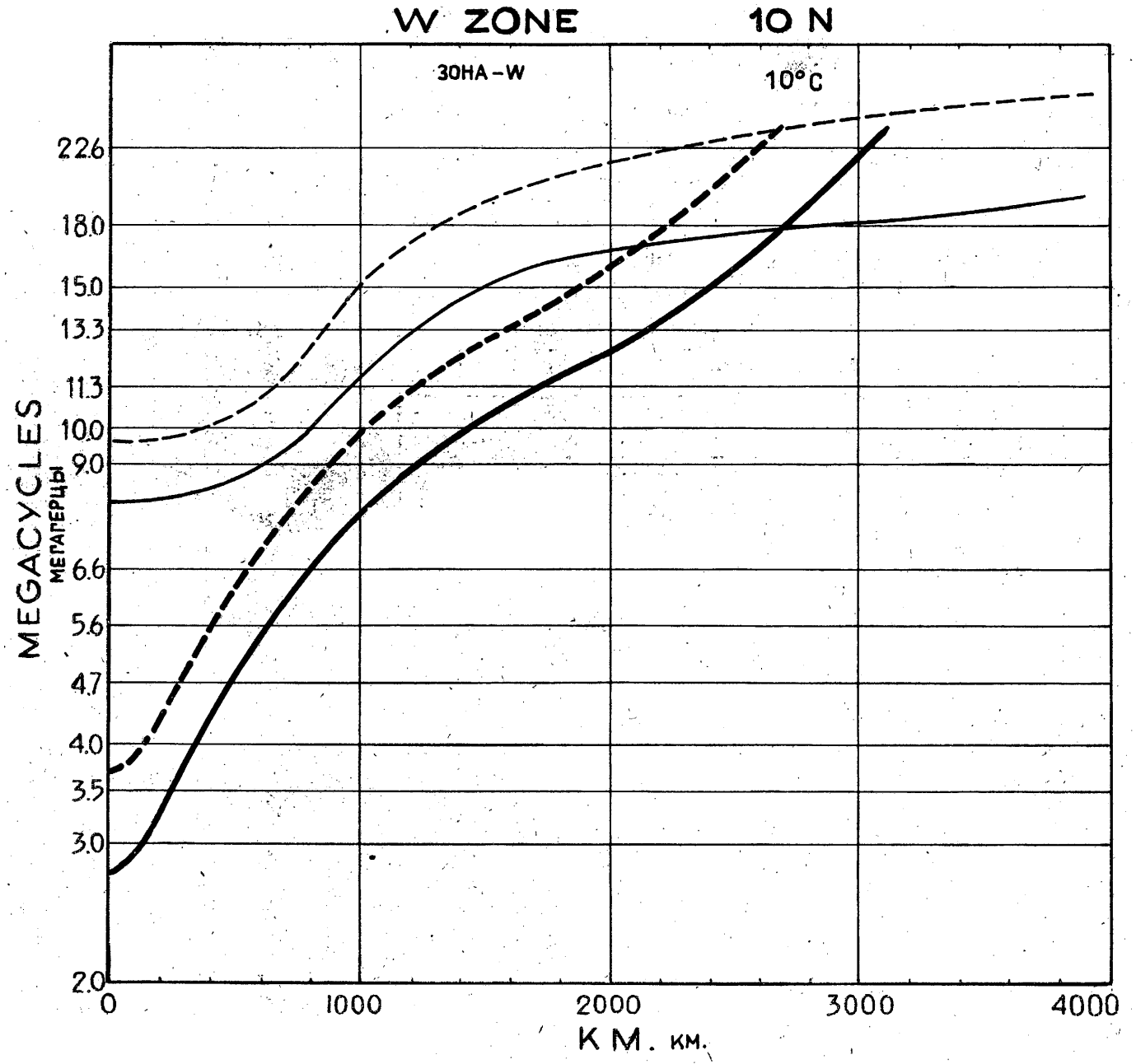

W ZONE
10 N
30HA – W
10° C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 45 Рис. 45

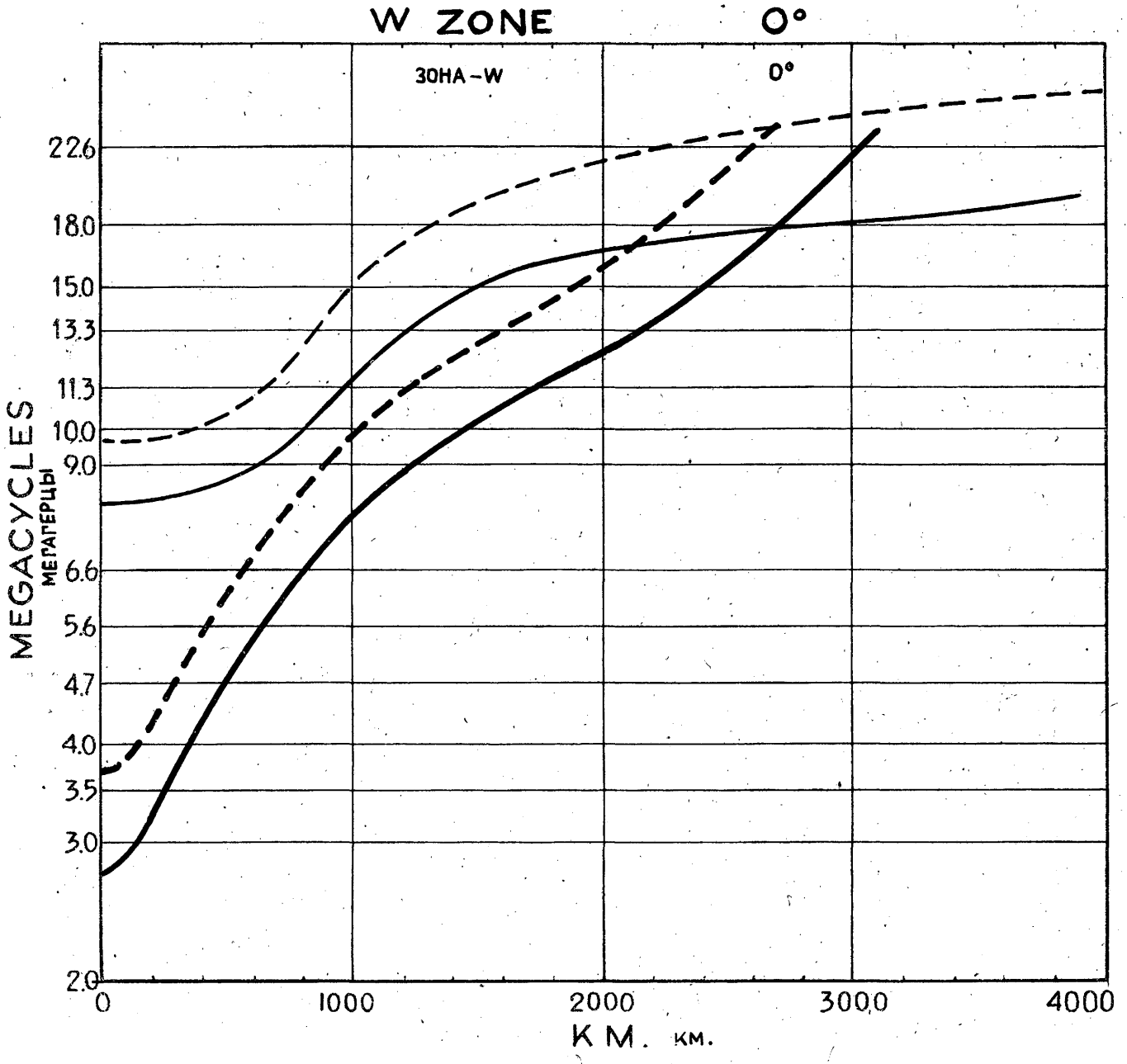

W ZONE
0°
30HA-W
0°
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 46 Рис. 46

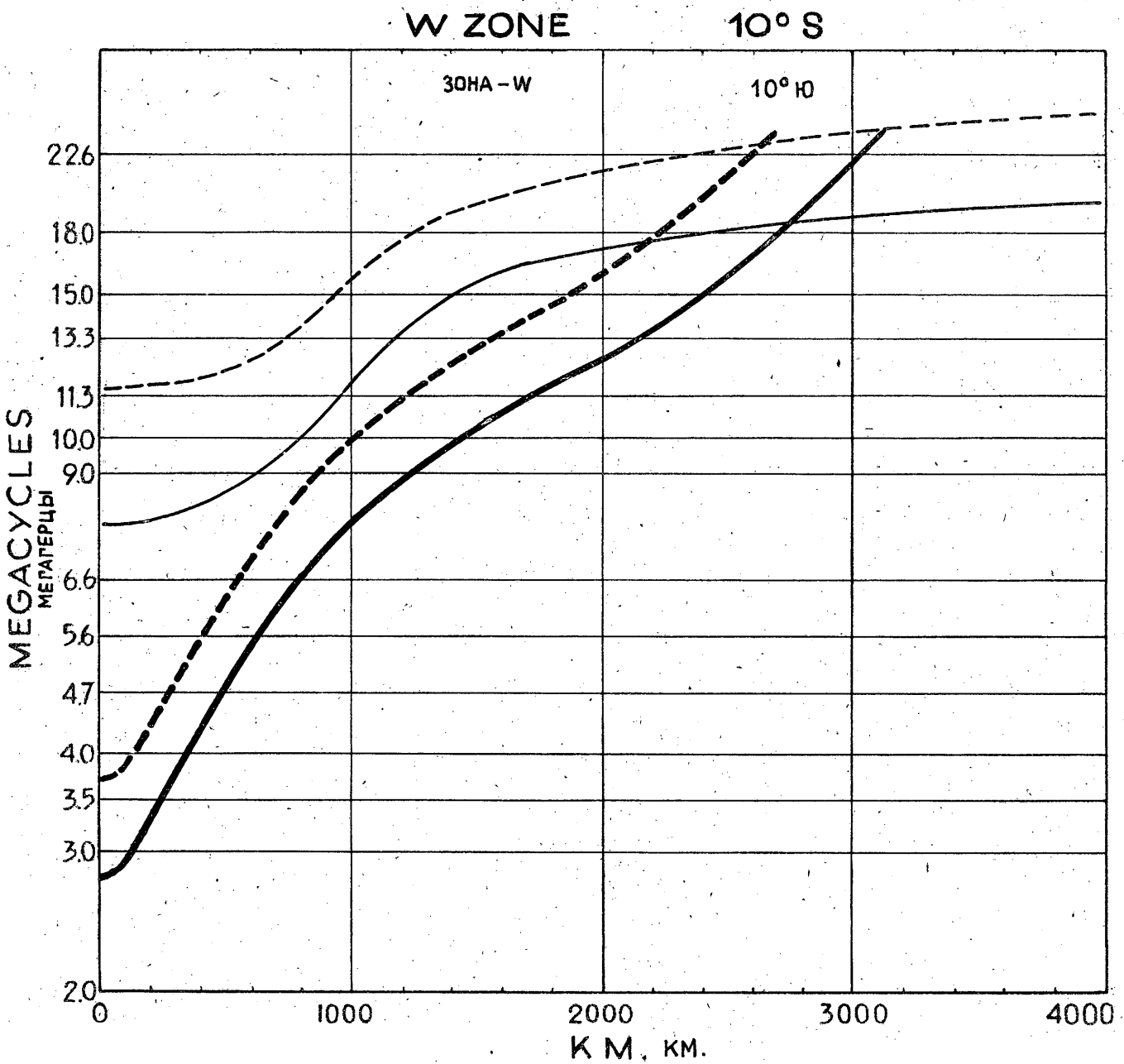

W ZONE
10° S
ЗОНА – W
10° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 47 Рис. 47

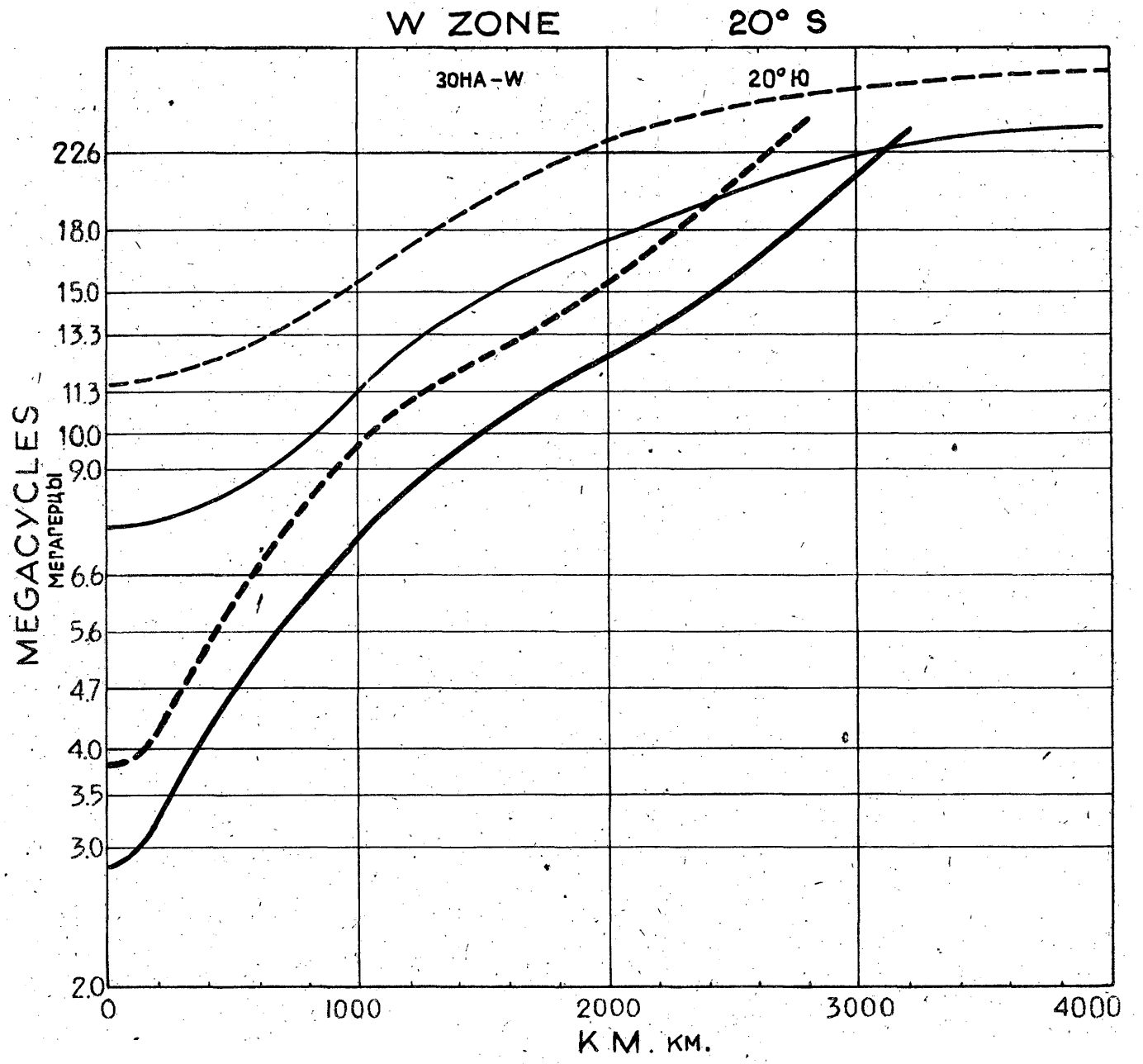

W ZONE 20° S
ЗОНА – W
20° Ю
MEGACYCLES
МЕГАГЕРЦЫ
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
0
1000
2000
3000
4000
K M. км.

Fig. 48 Рис. 48

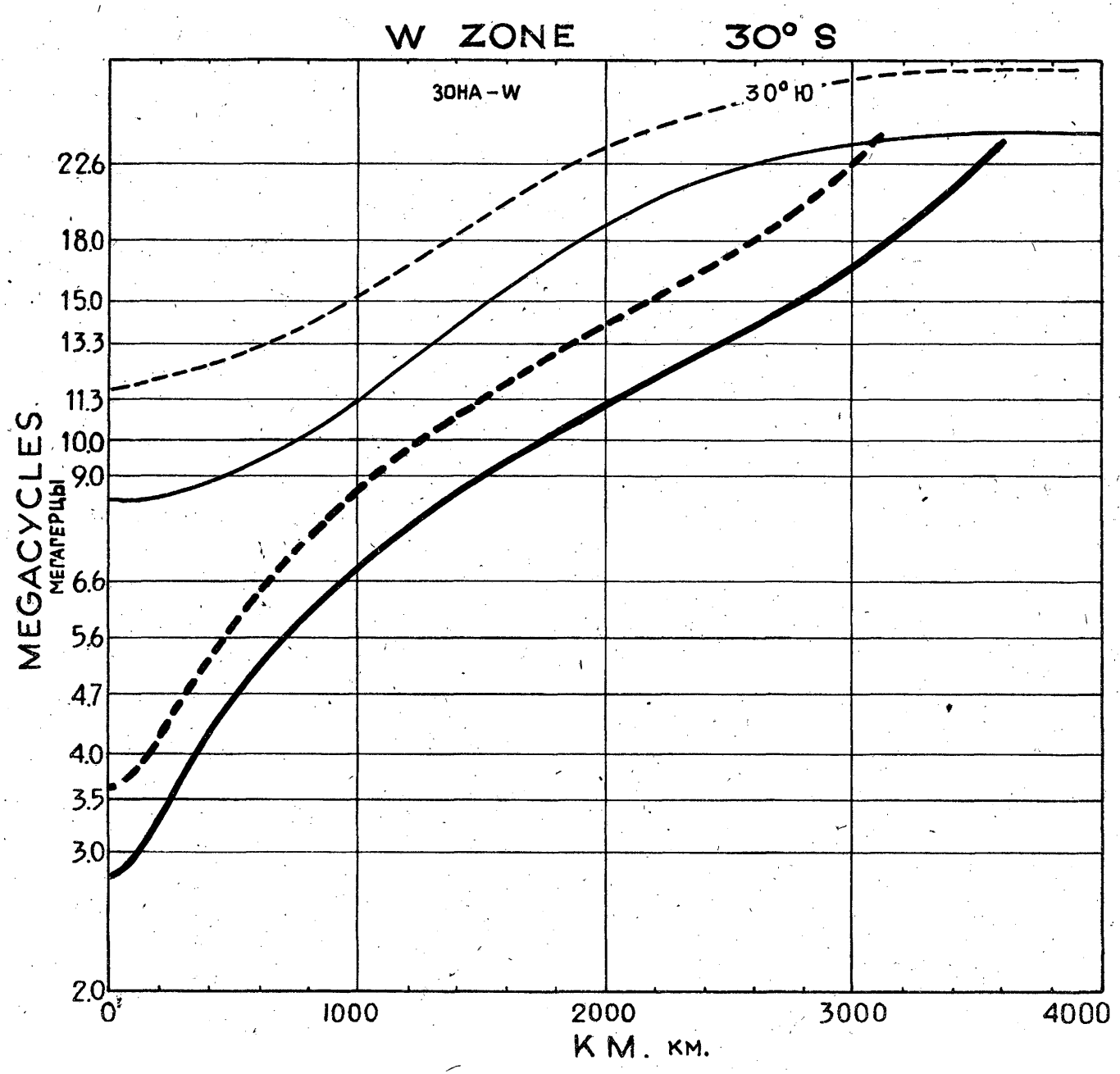

W ZONE 30° S
ЗОНА – W
30° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 49 Рис. 49

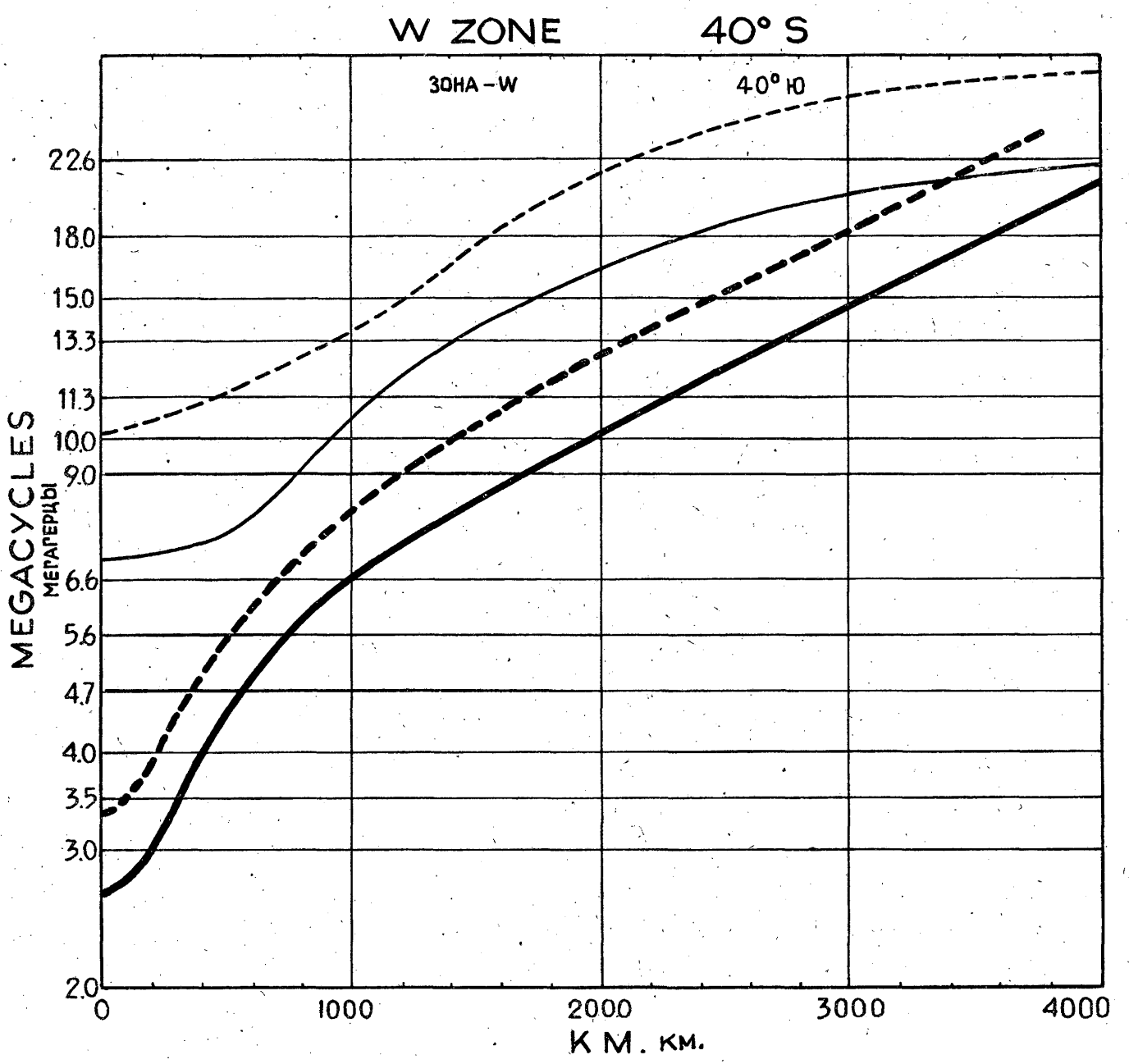

W ZONE 40° S
ЗОНА – W
40° Ю
MEGACYCLES
МЕГАГЕРЦЫ
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
0
1000
2000
3000
4000
K M. км.

Fig. 50 Рис.50

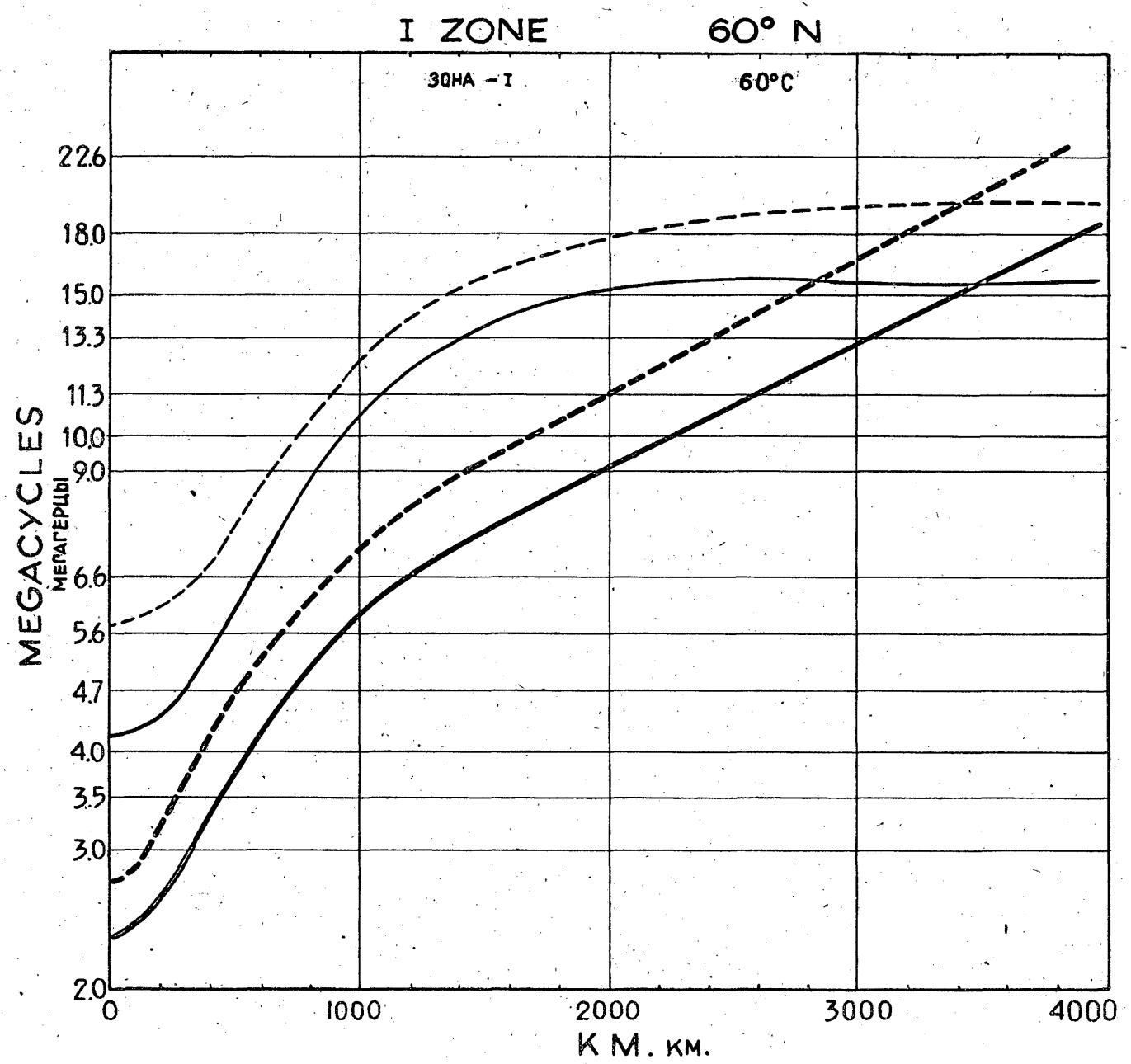

I ZONE
60° N
ЗОНА – I
60°С
MEGACYCLES
МЕГАГЕРЦЫ
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
0
1000
2000
3000
4000
K M. км.

Fig. 51 Рис. 51

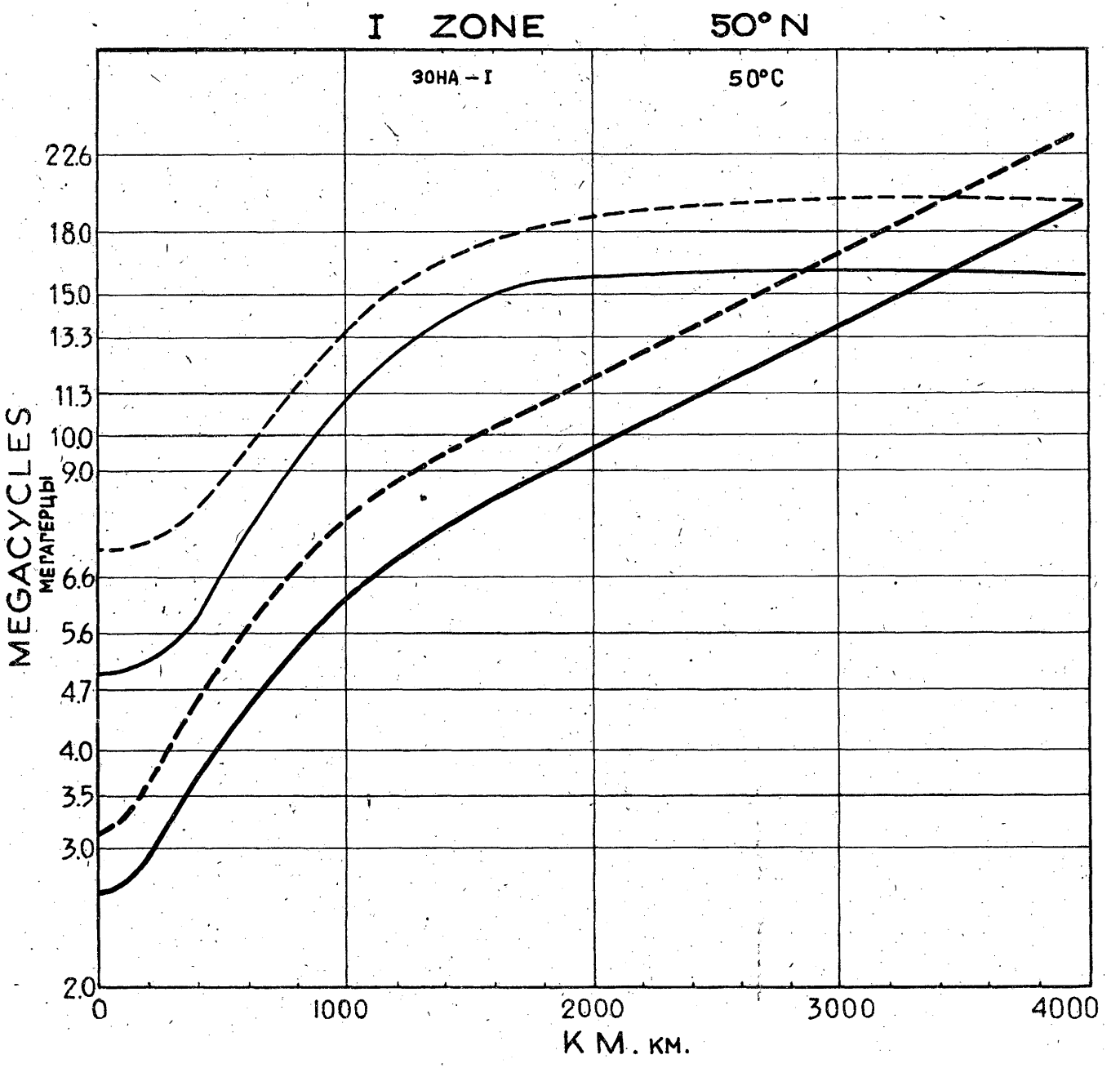

I ZONE
50° N
ЗОНА – I
50°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 52 Рис. 52

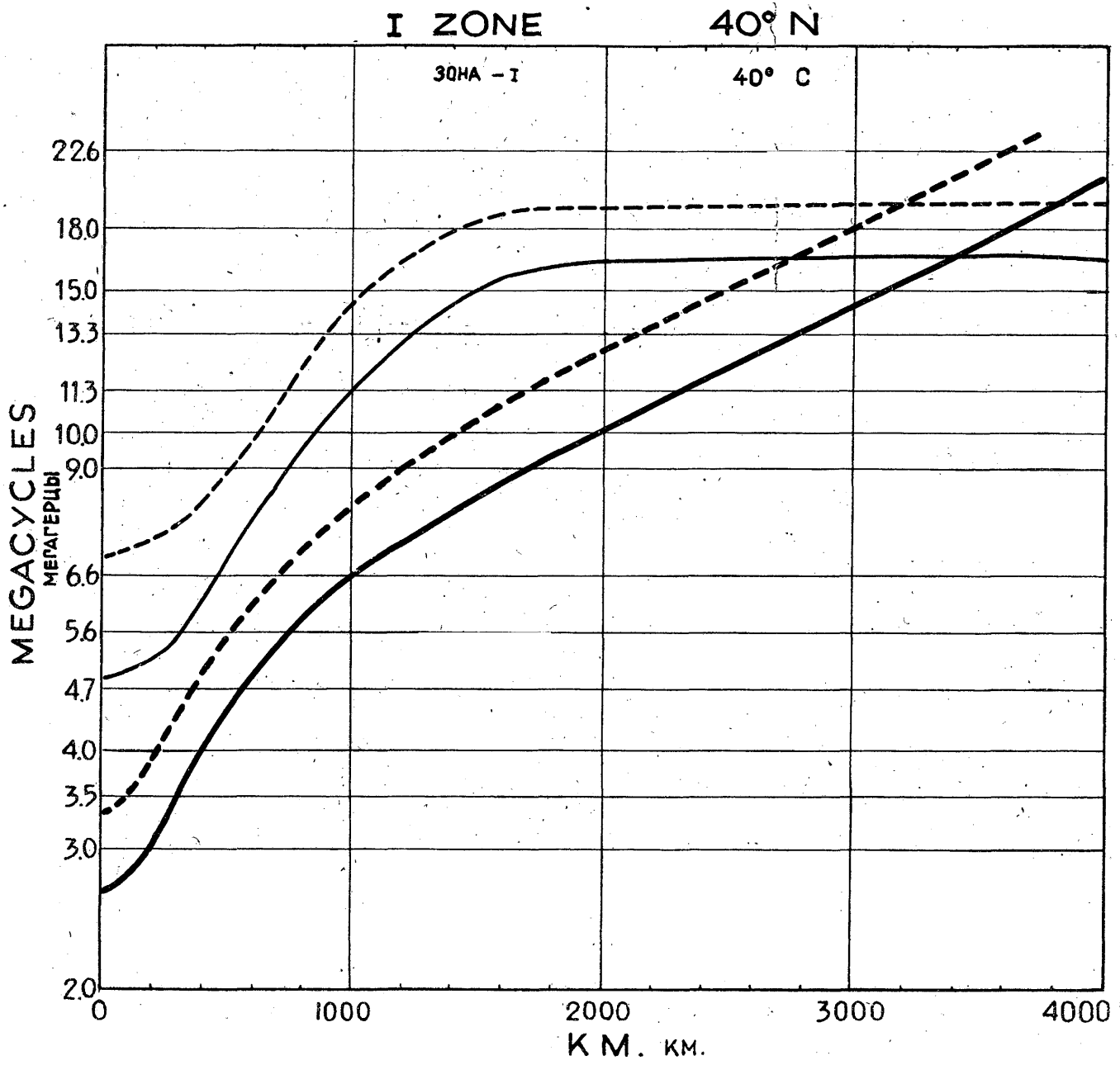

I ZONE
40° N
ЗОНА - I
40° C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 53 Рис. 53

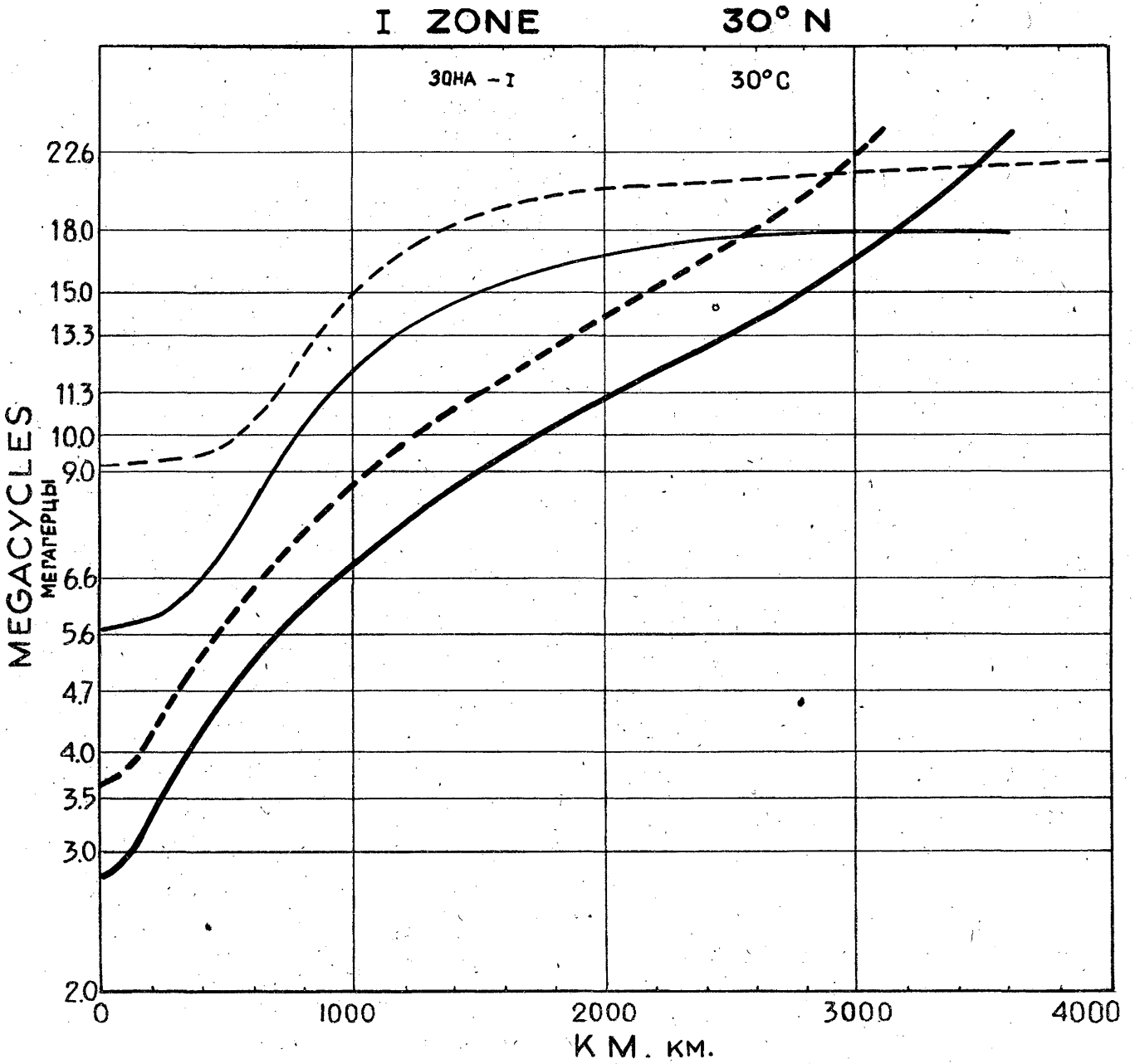

I ZONE
30° N
ЗОНА - I
30°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 54 Рис. 54

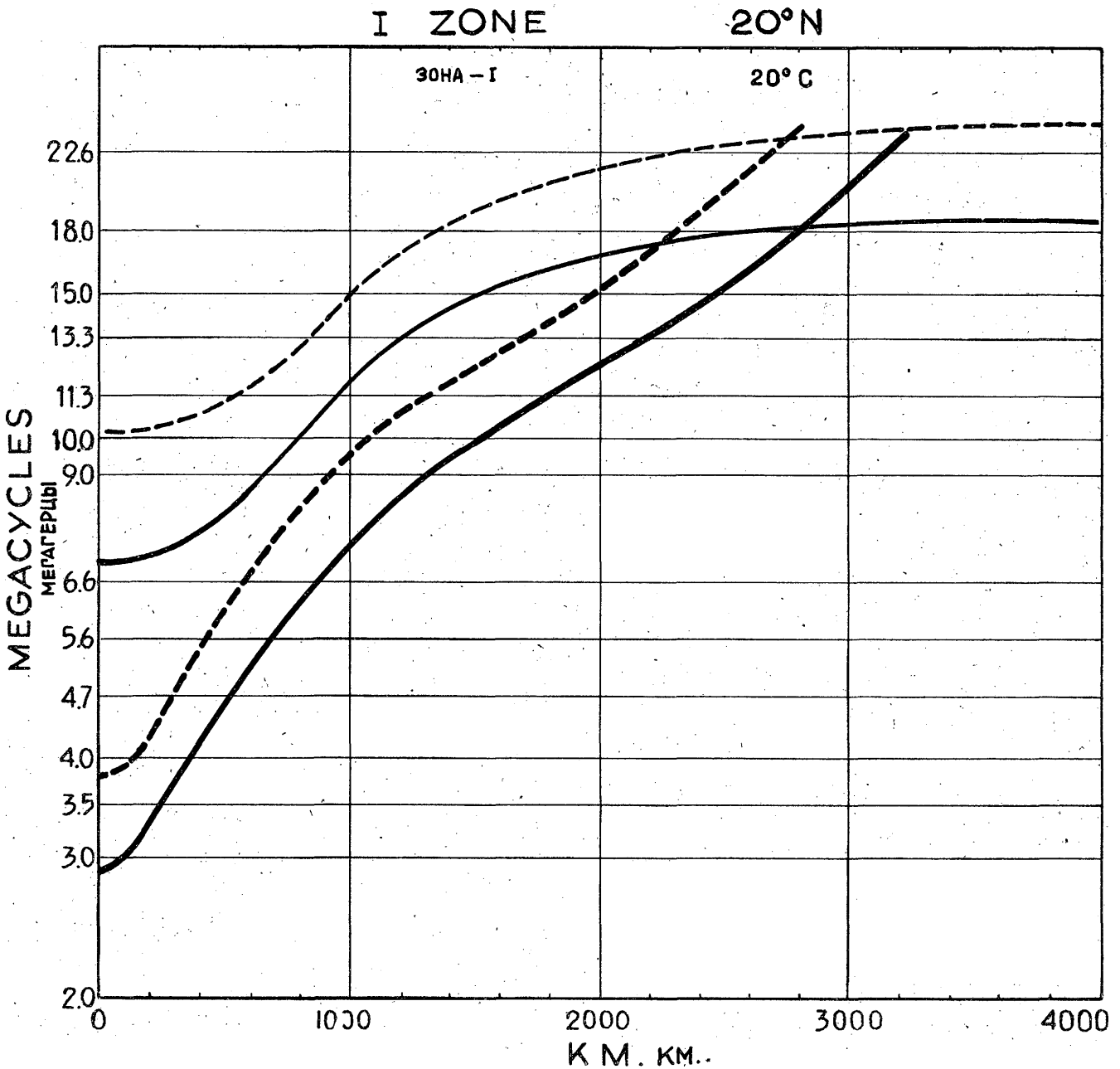

I ZONE 20°N
ЗОНА – I
20° C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ..

Fig. 55 Рис. 55

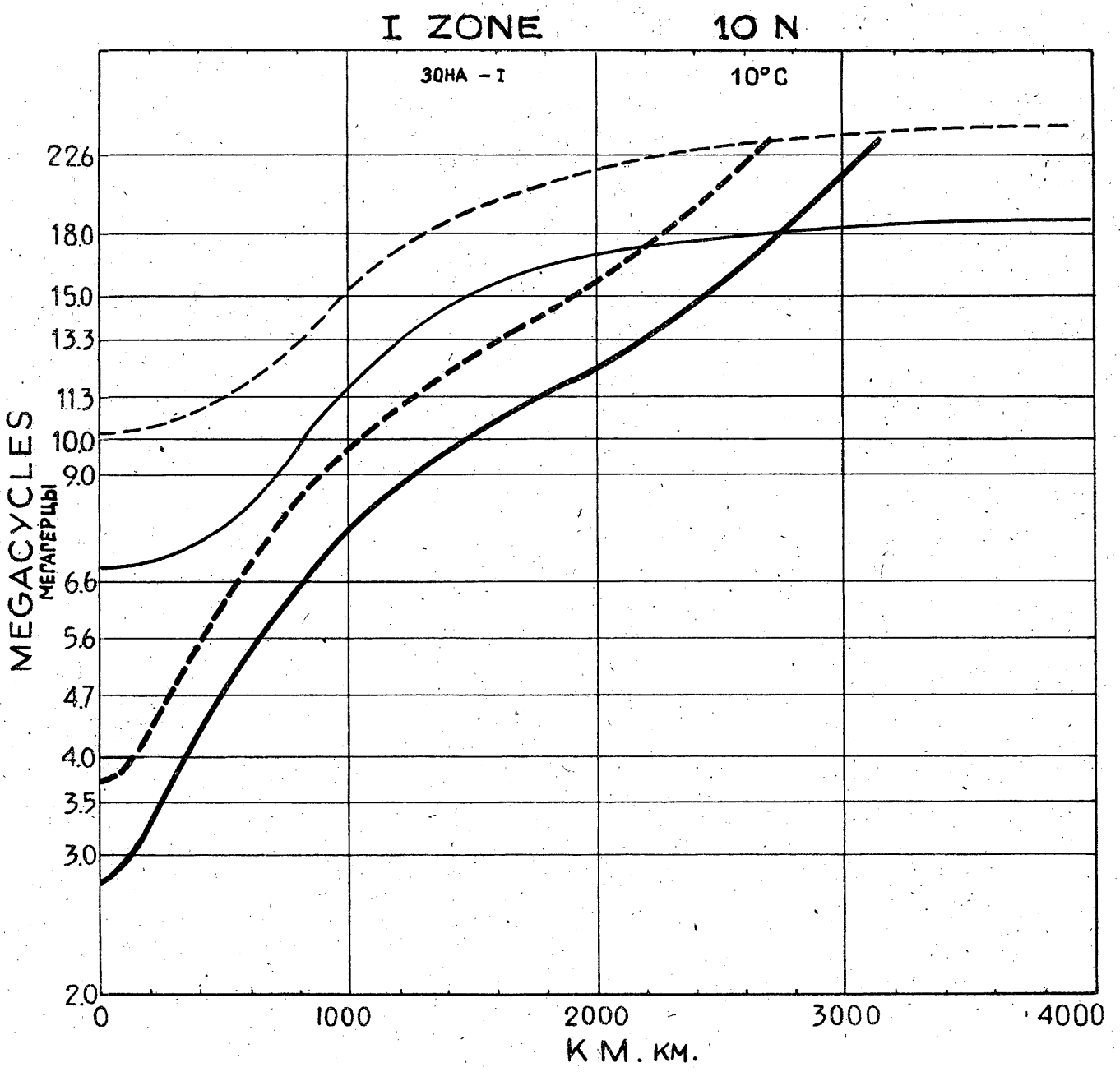

I ZONE
10 N
ЗОНА - I
10°C
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 56 Рис. 56

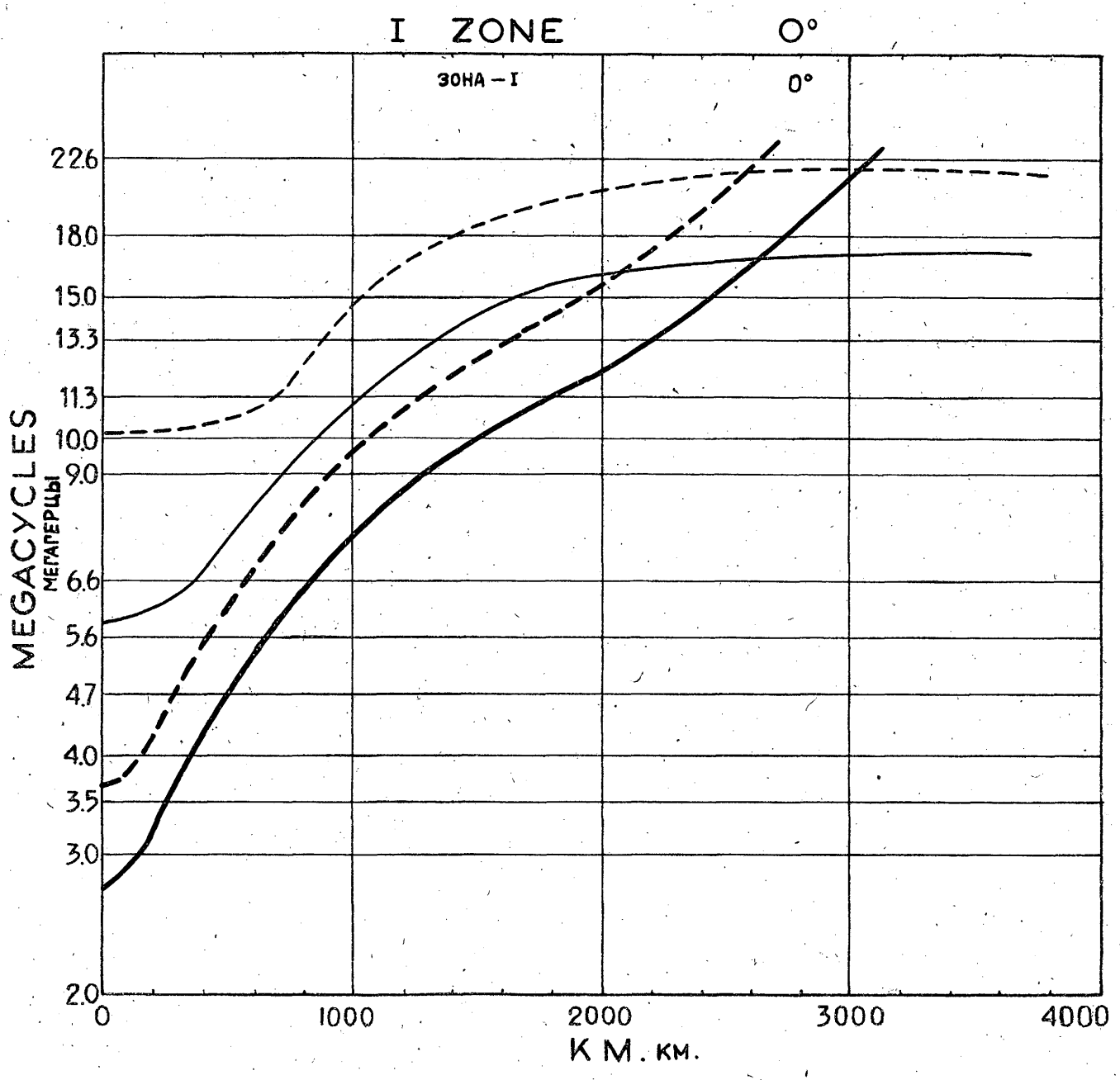

I ZONE
0°
ЗОНА – I
0°
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 57 Рис.57

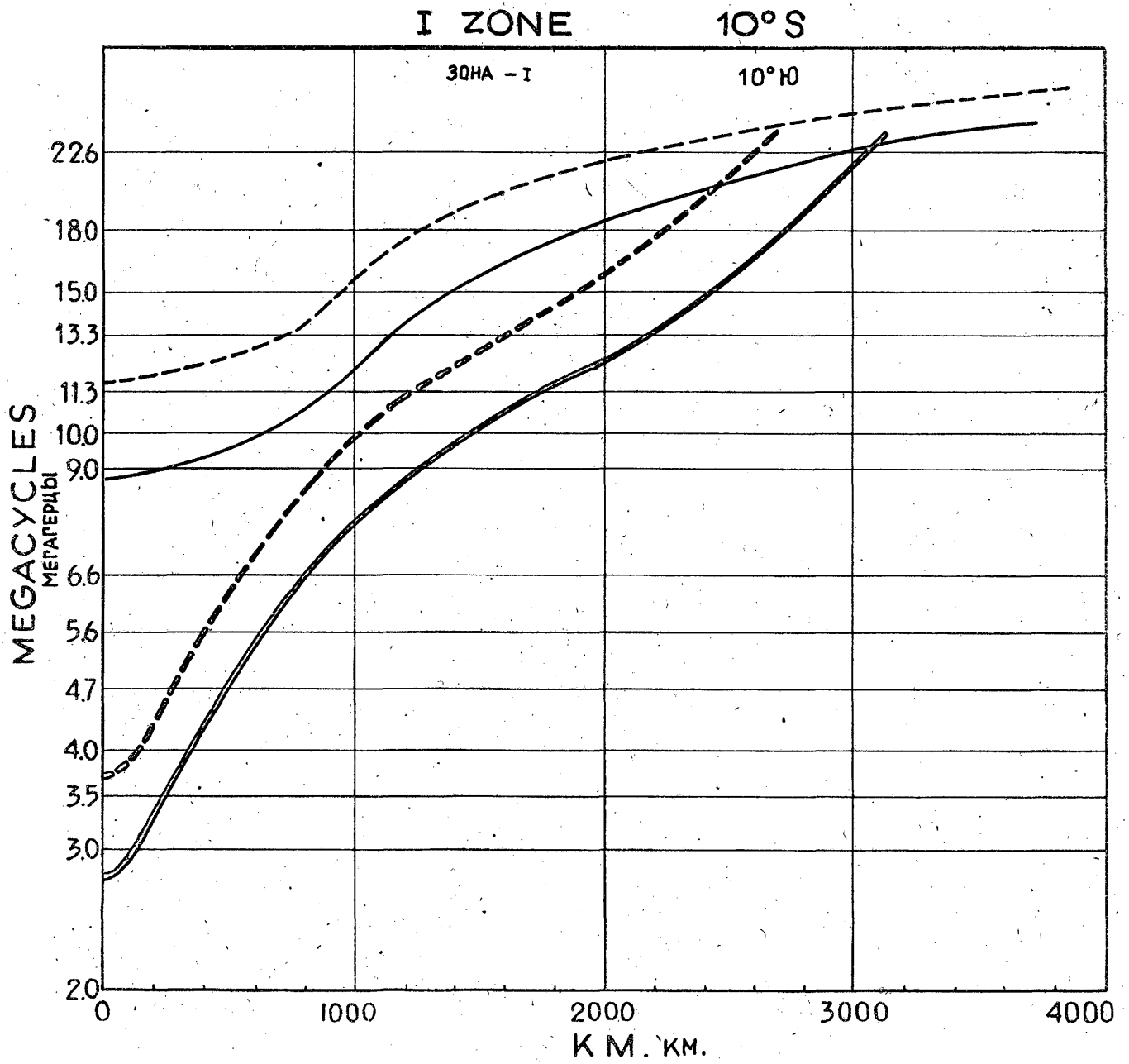

I ZONE 10° S
ЗОНА – I
10° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 58 Рис. 58

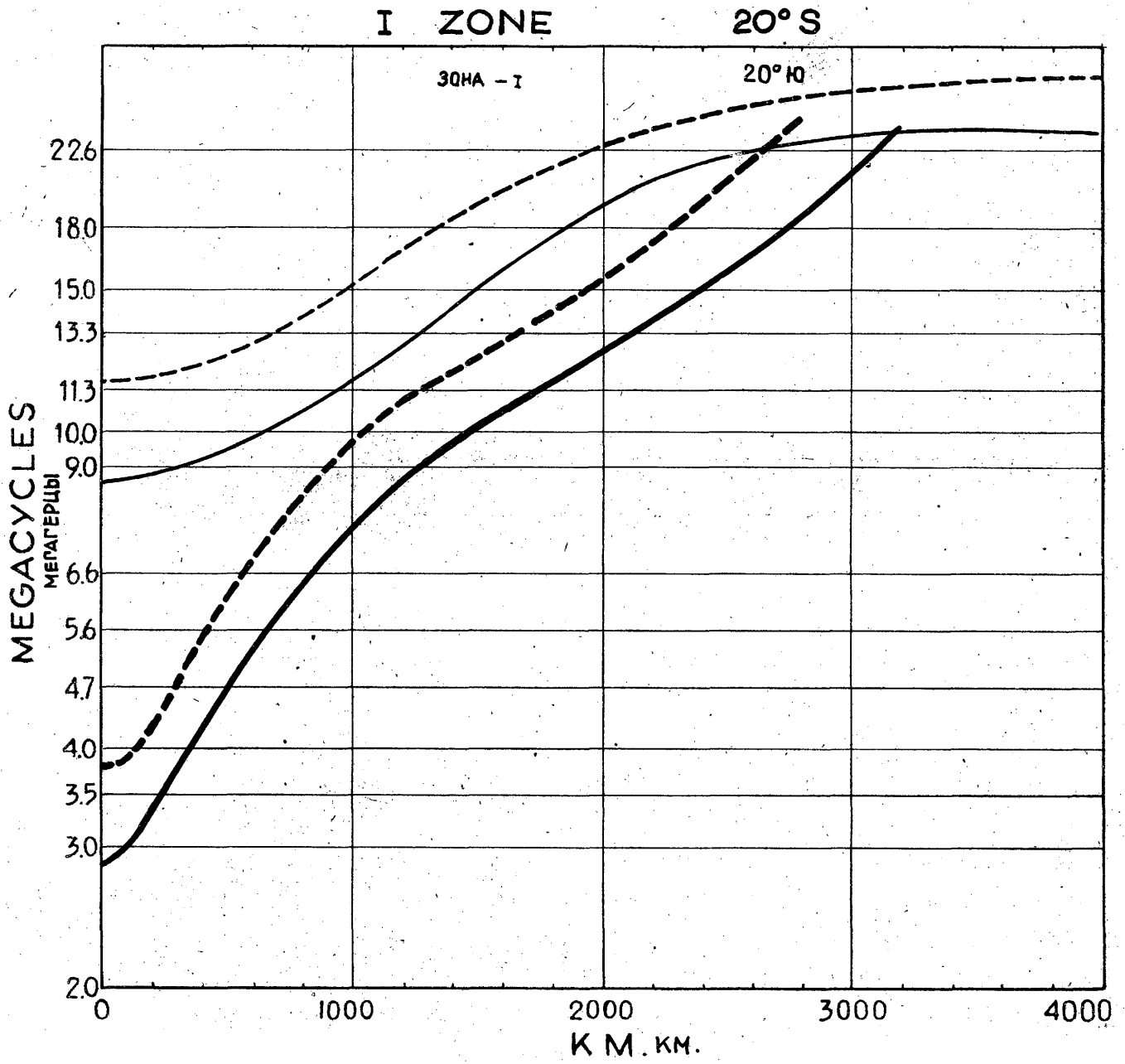

I ZONE
20° S
ЗОНА – I
20° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. KM.

Fig. 59 Рис. 59

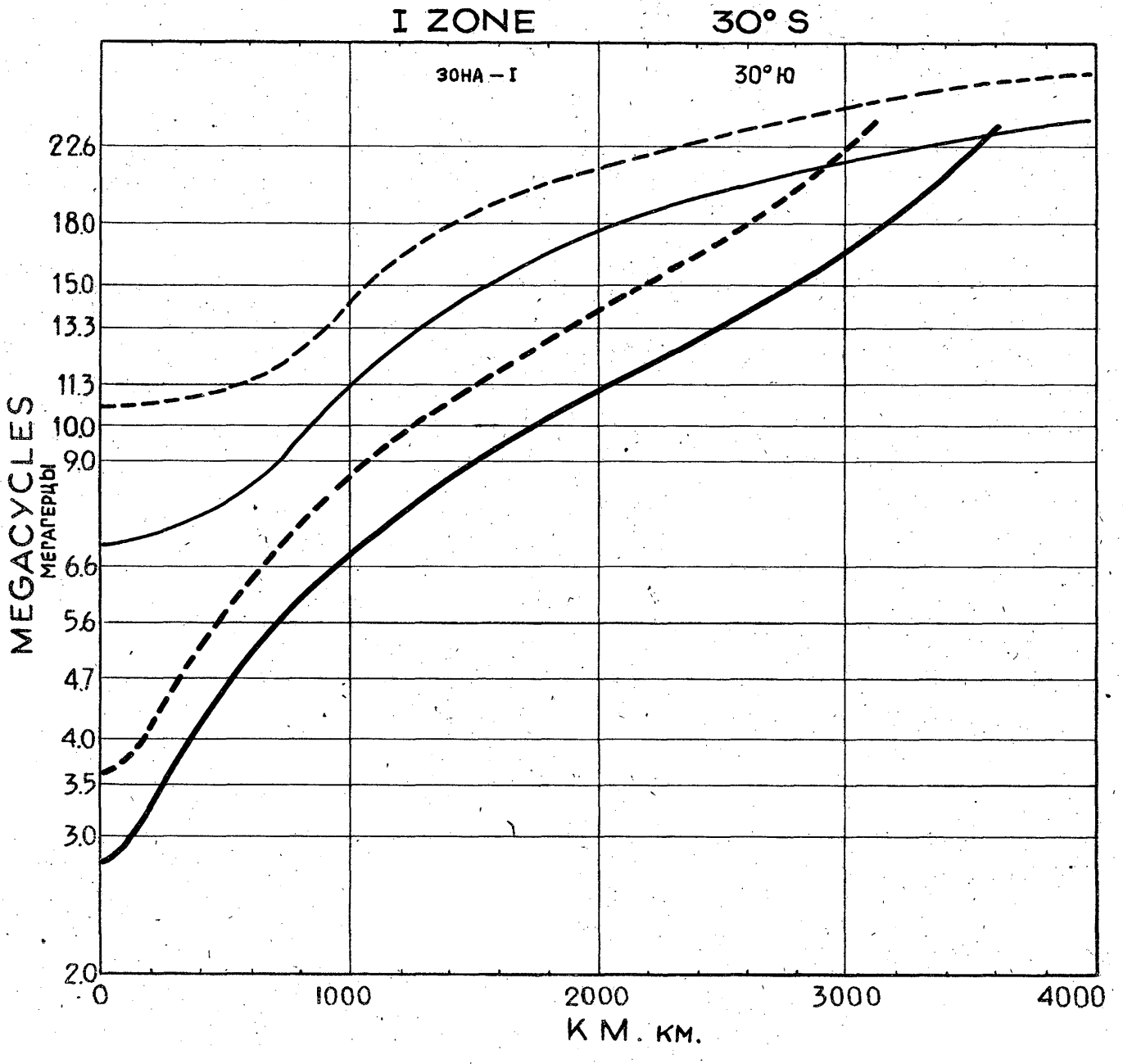

I ZONE
30° S
ЗОНА – I
30° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАПЕРИОДЫ
0
1000
2000
3000
4000
K M. KM.

Fig. 60 Рис. 60

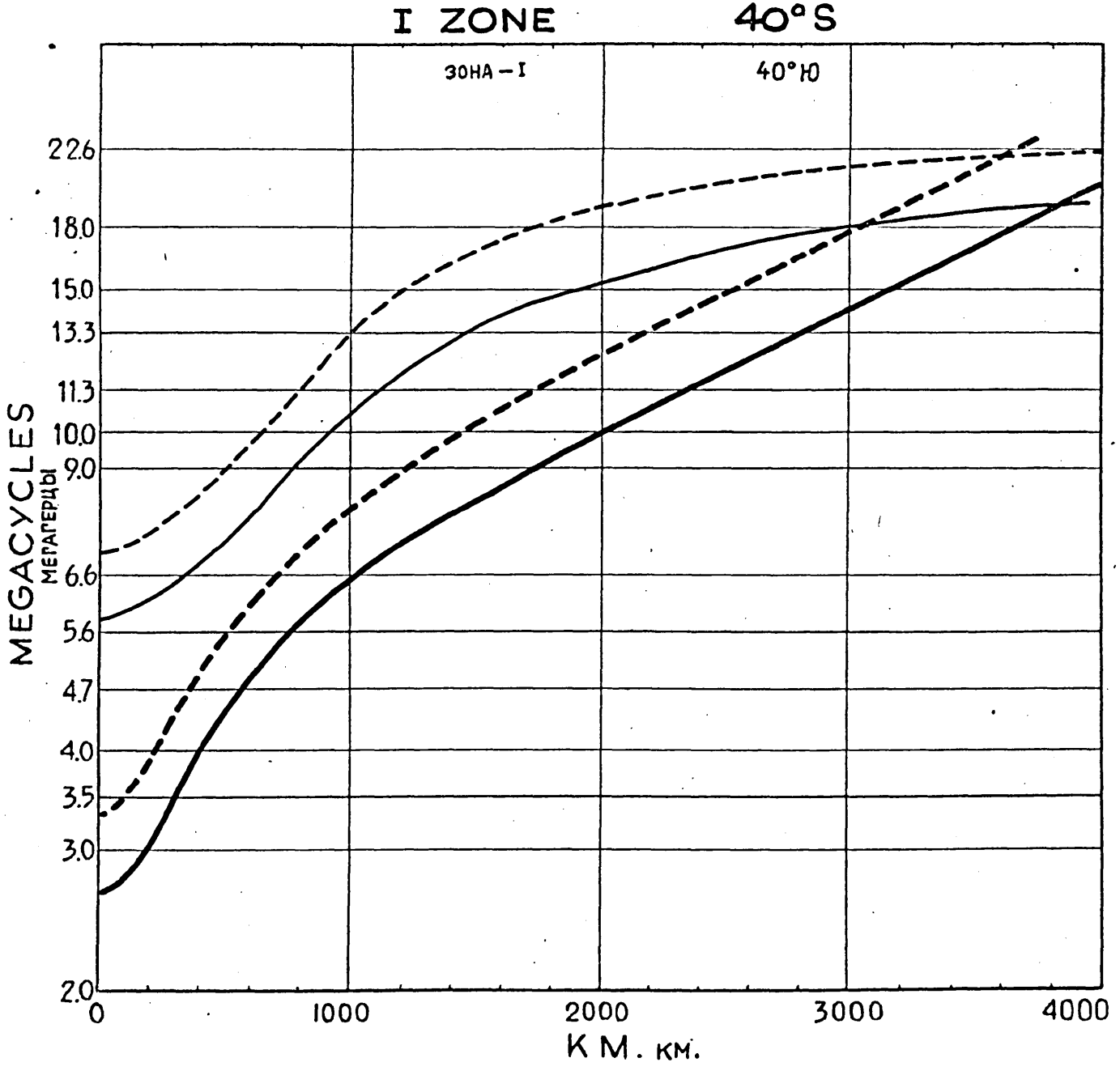

I ZONE
40° S
ЗОНА – I
40° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 61 Рис. 61

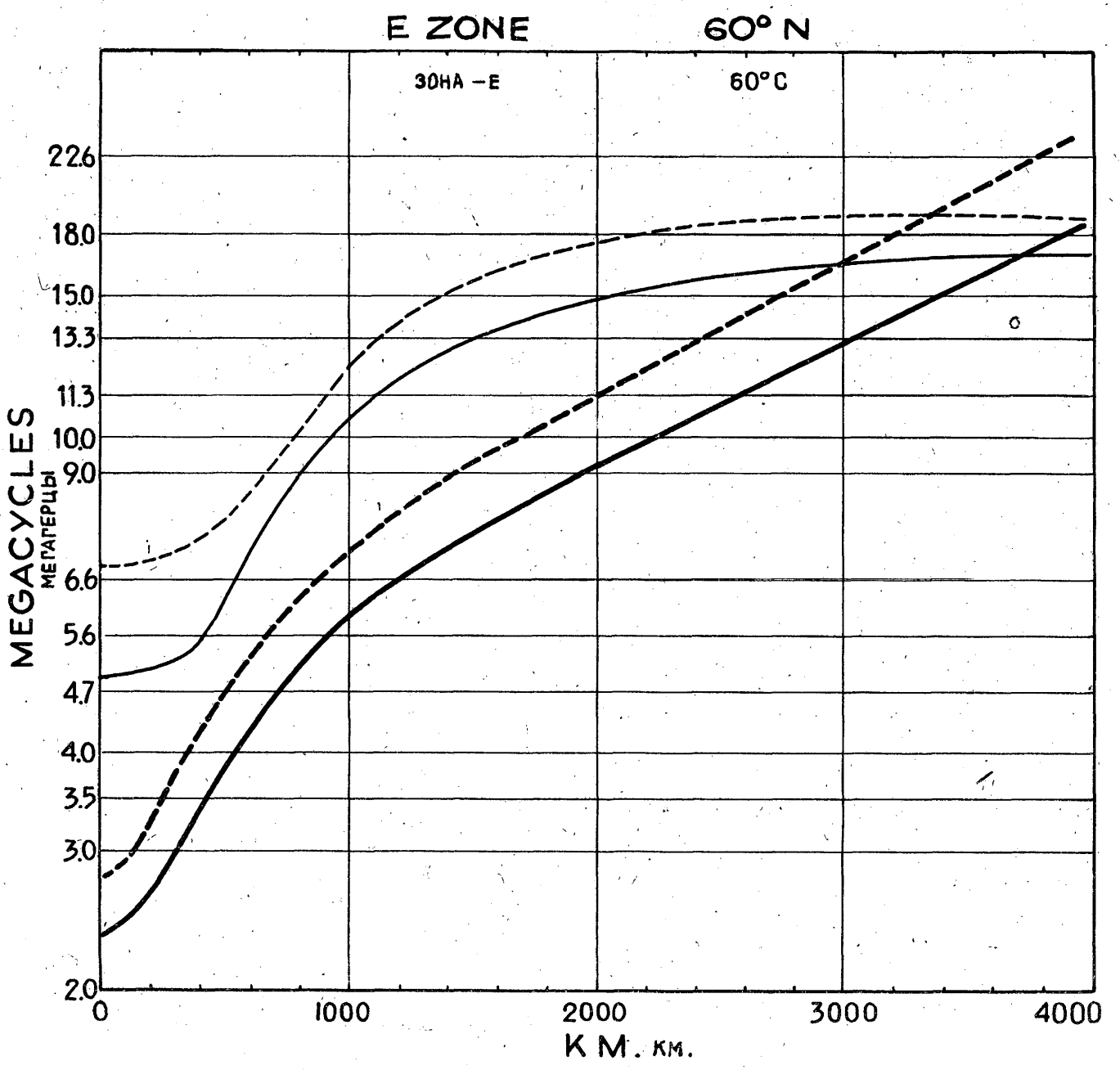

E ZONE
60° N
ЗОНА – Е
60° С
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 62 Рис. 62

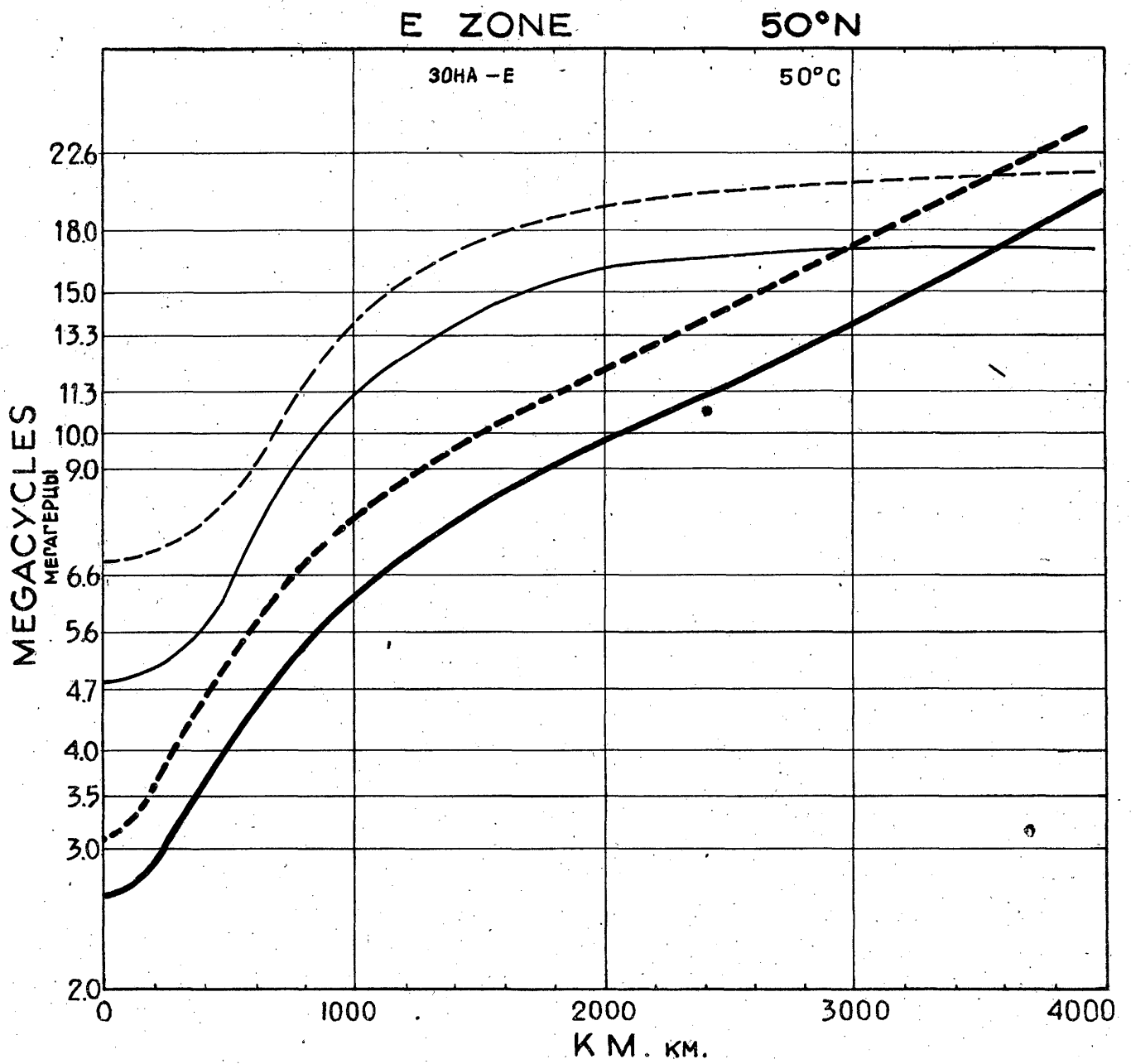

E ZONE
50°N
ЗОНА – Е
50°С
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 63 Рис. 63

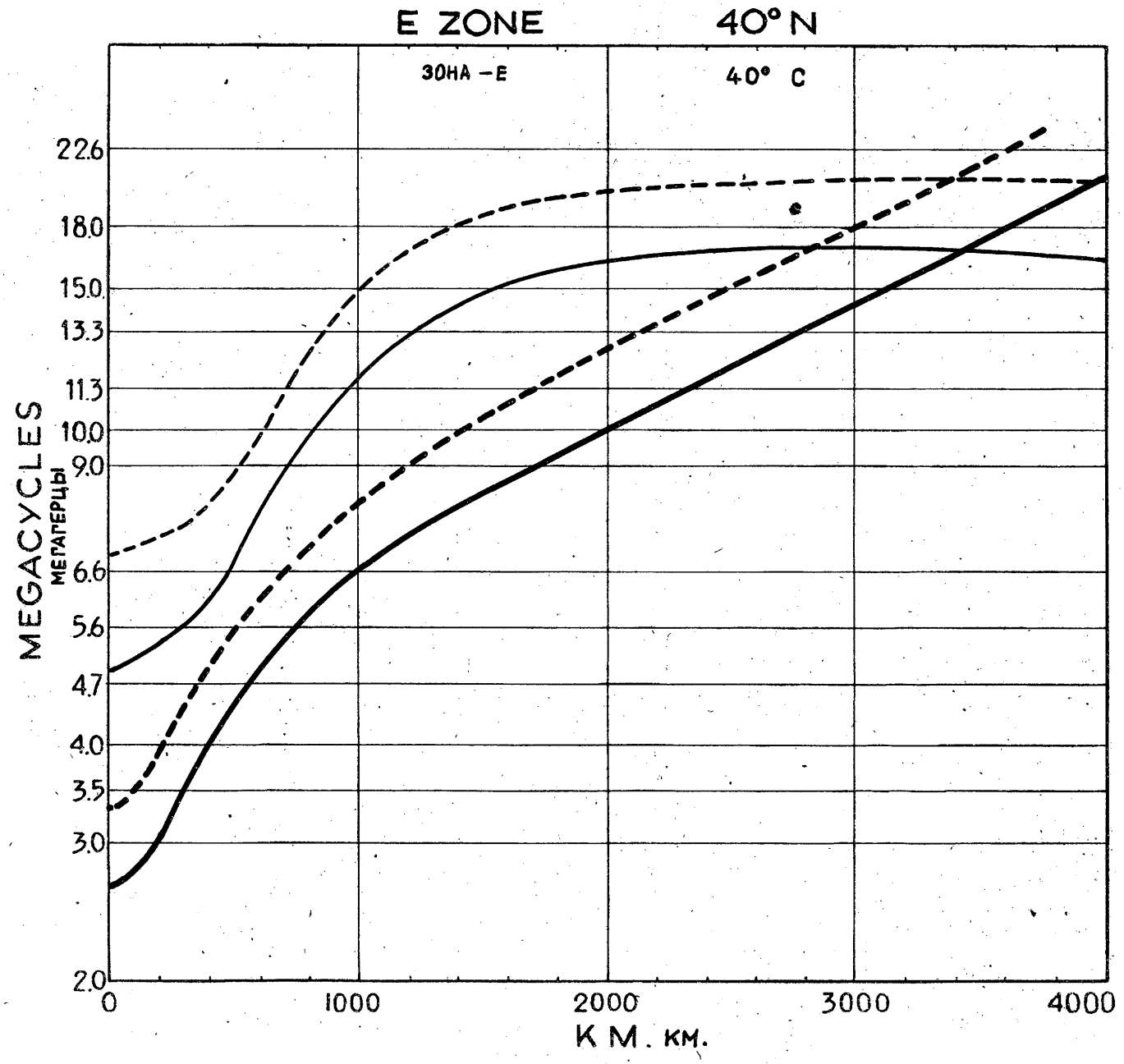

E ZONE
40° N
ЗОНА – Е
40° С
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 64 Рис. 64

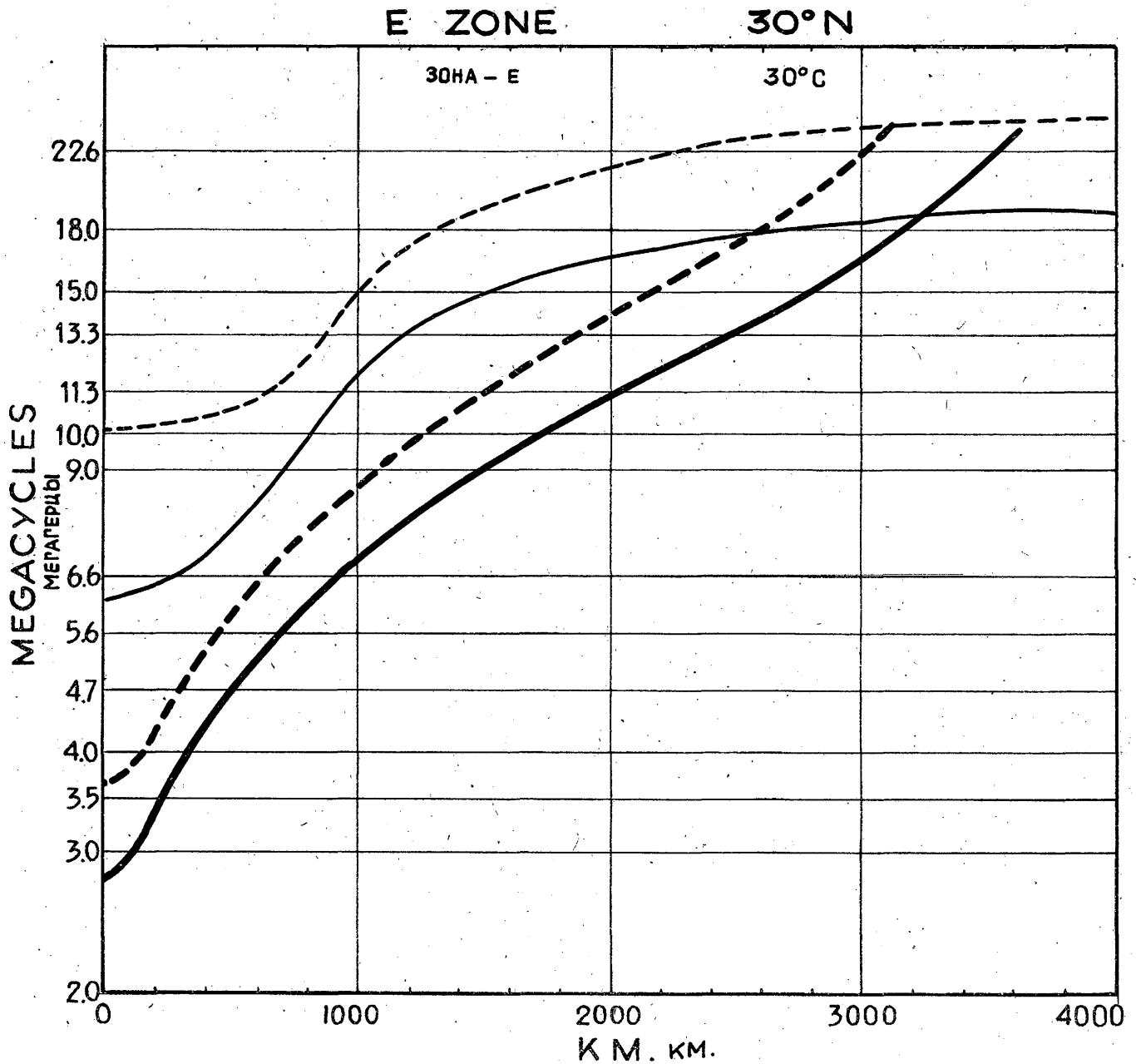

E ZONE
30° N
ЗОНА – Е
30° С
MEGACYCLES
МЕГАГЕРЦЫ
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
0
1000
2000
3000
4000
K M. км.

Fig. 65 Рис. 65

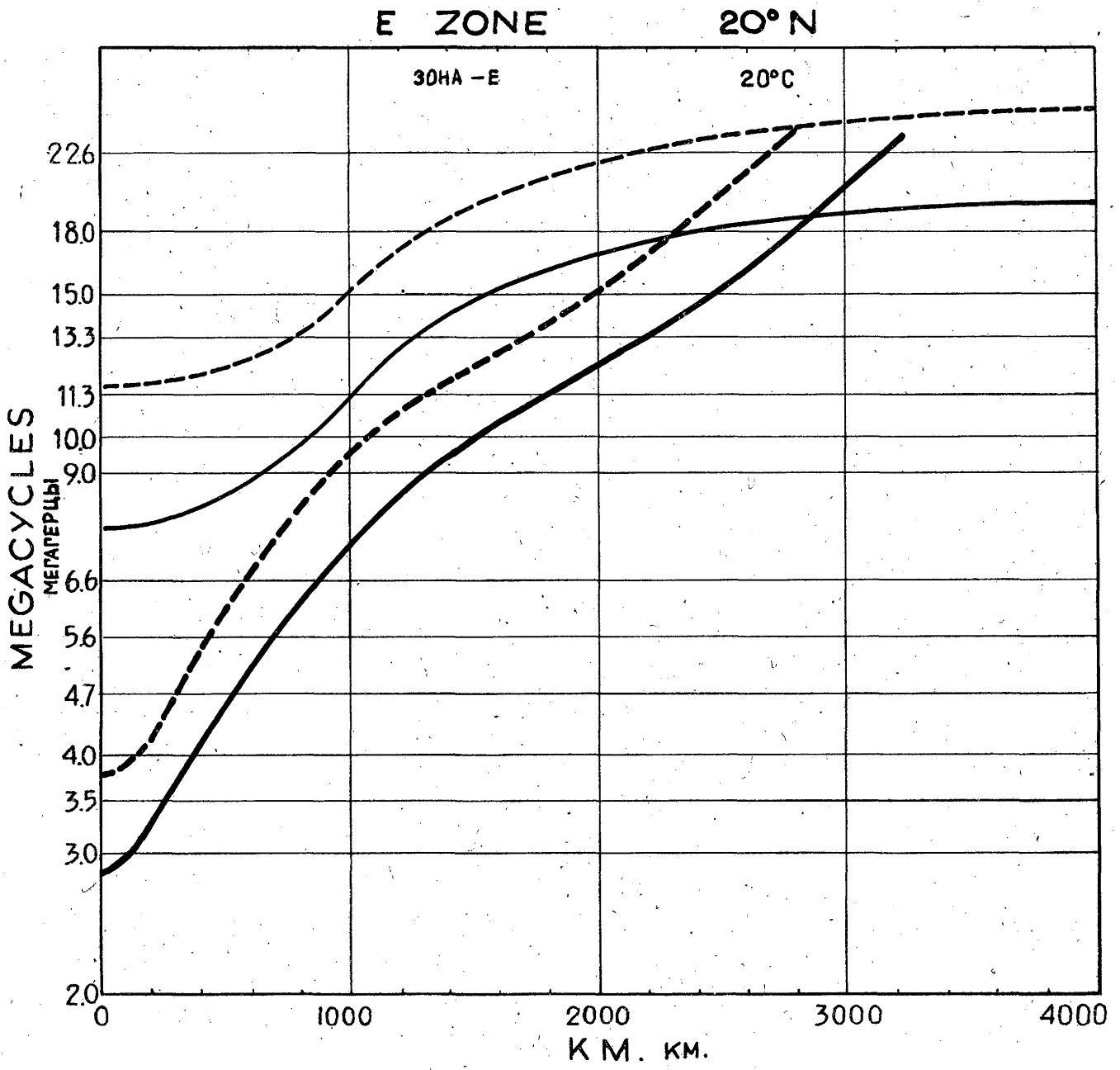

E ZONE 20° N
ЗОНА – Е
20°С
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
KM. КМ.

Fig. 66 Рис. 66

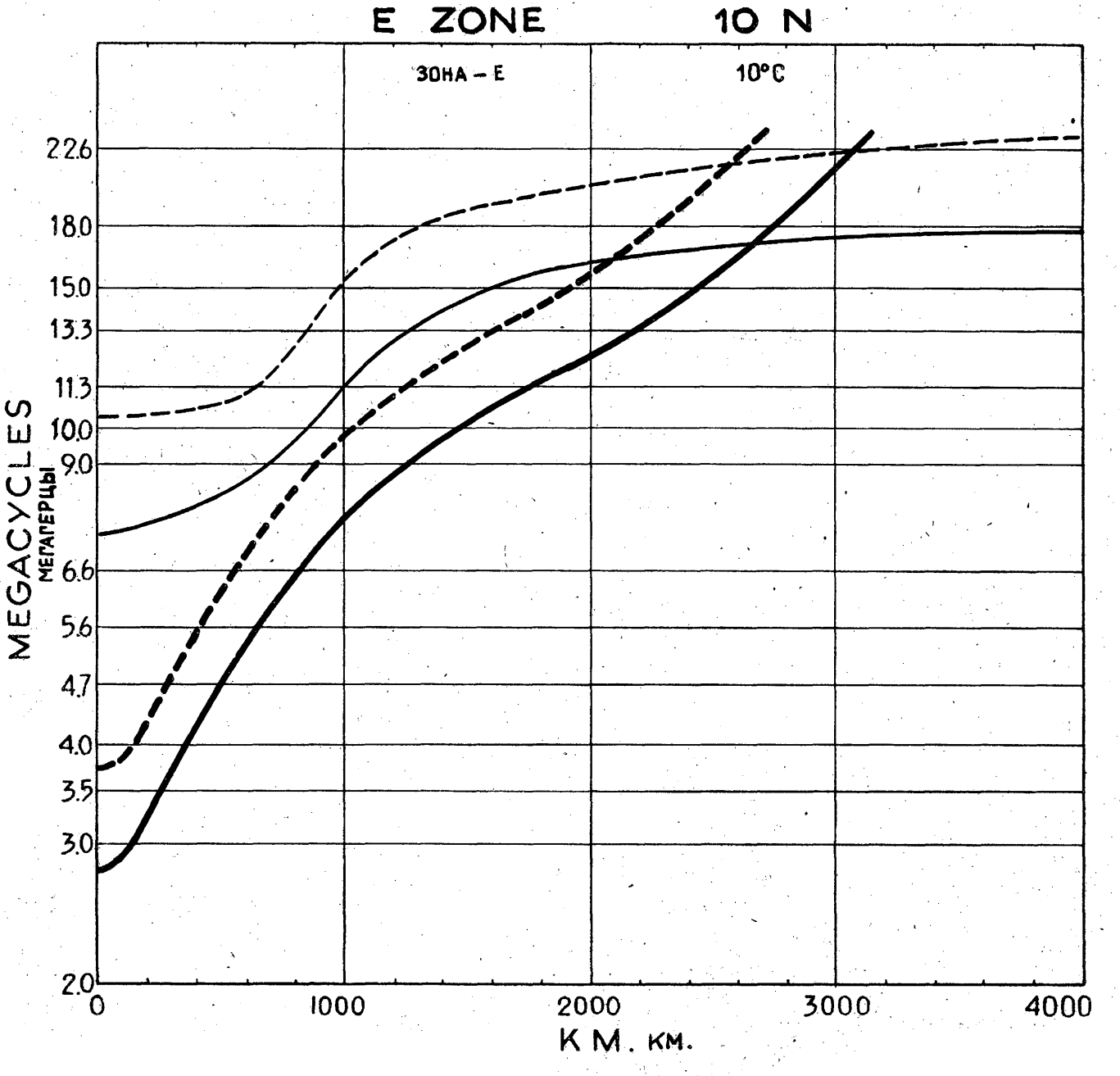

E ZONE 10 N
ЗОНА – Е
10°С
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 67 Рис. 67

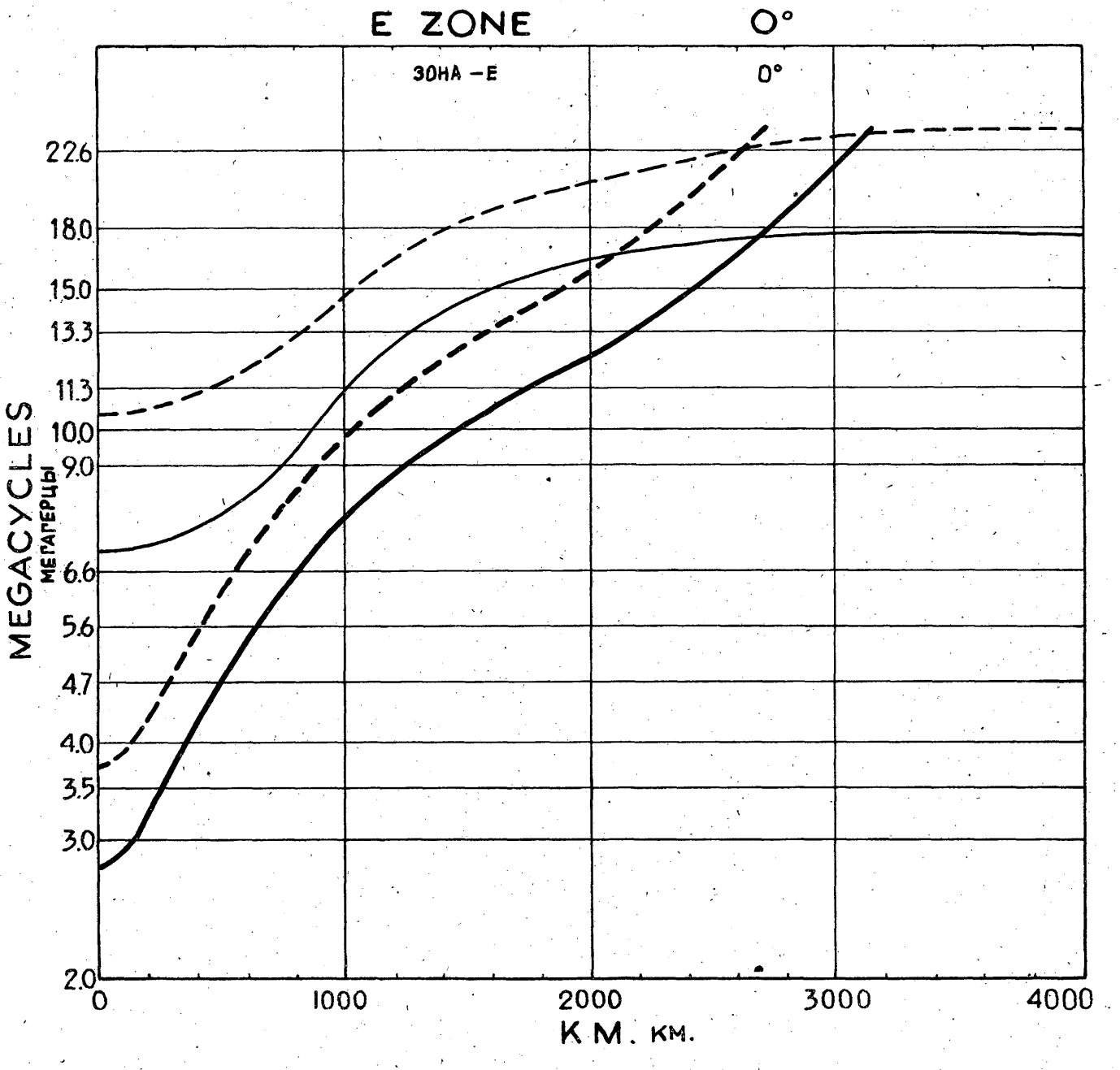

E ZONE
0°
ЗОНА – Е
0°
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 68 Рис. 68

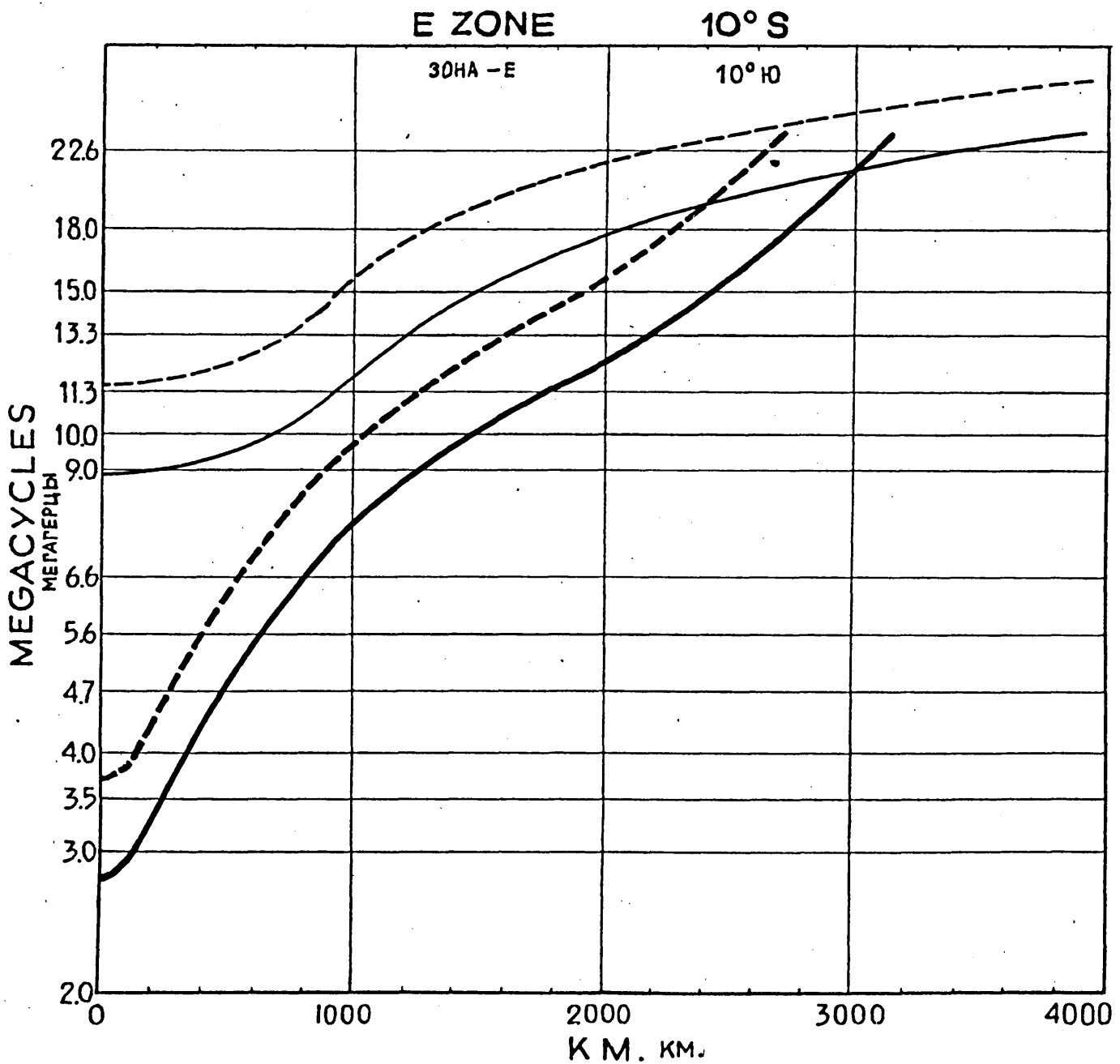

E ZONE
10° S
ЗОНА – Е
10° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 69 Рис. 69

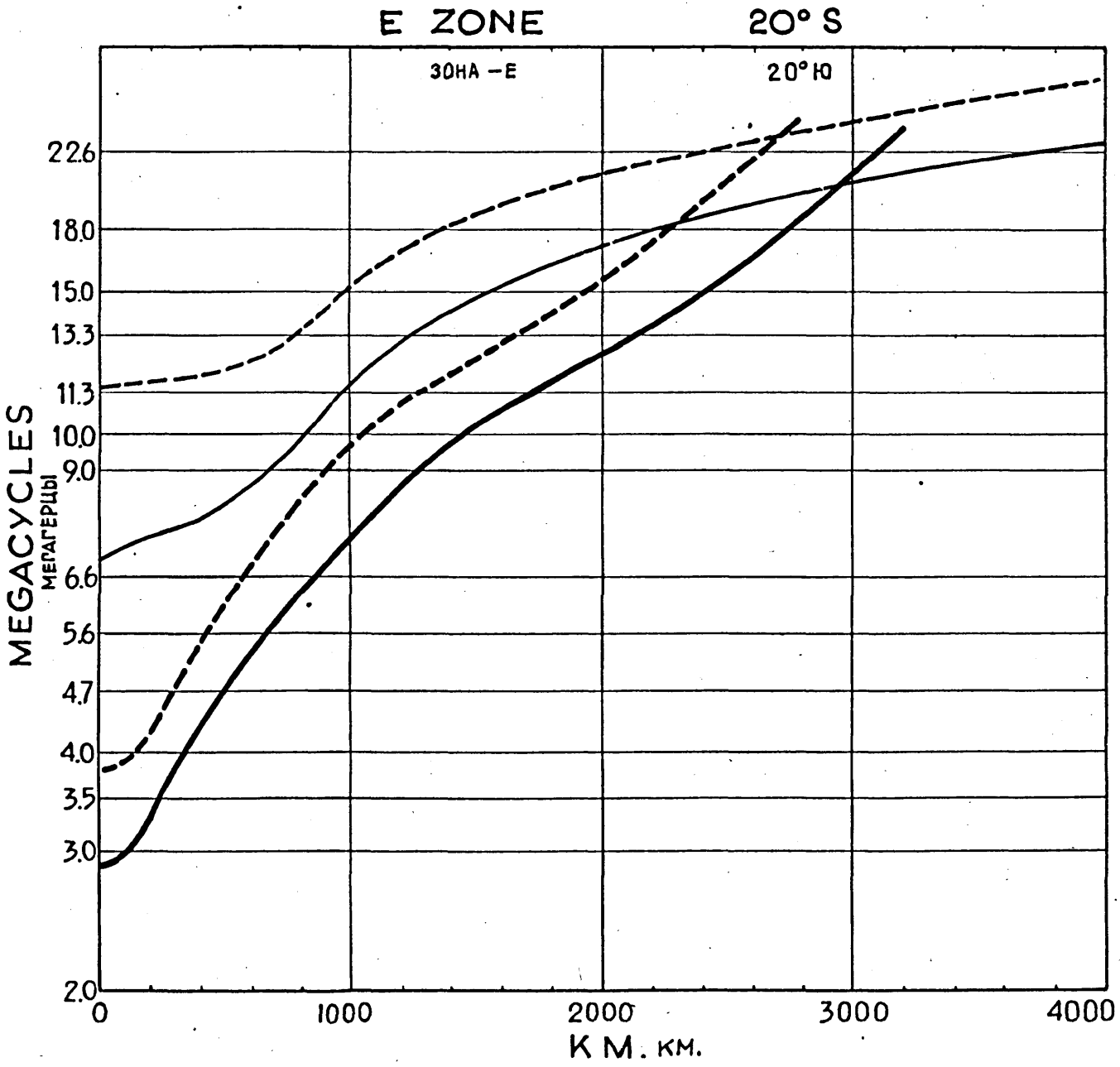

E ZONE
20° S
ЗОНА – Е
20° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. КМ.

Fig. 70 Рис. 70

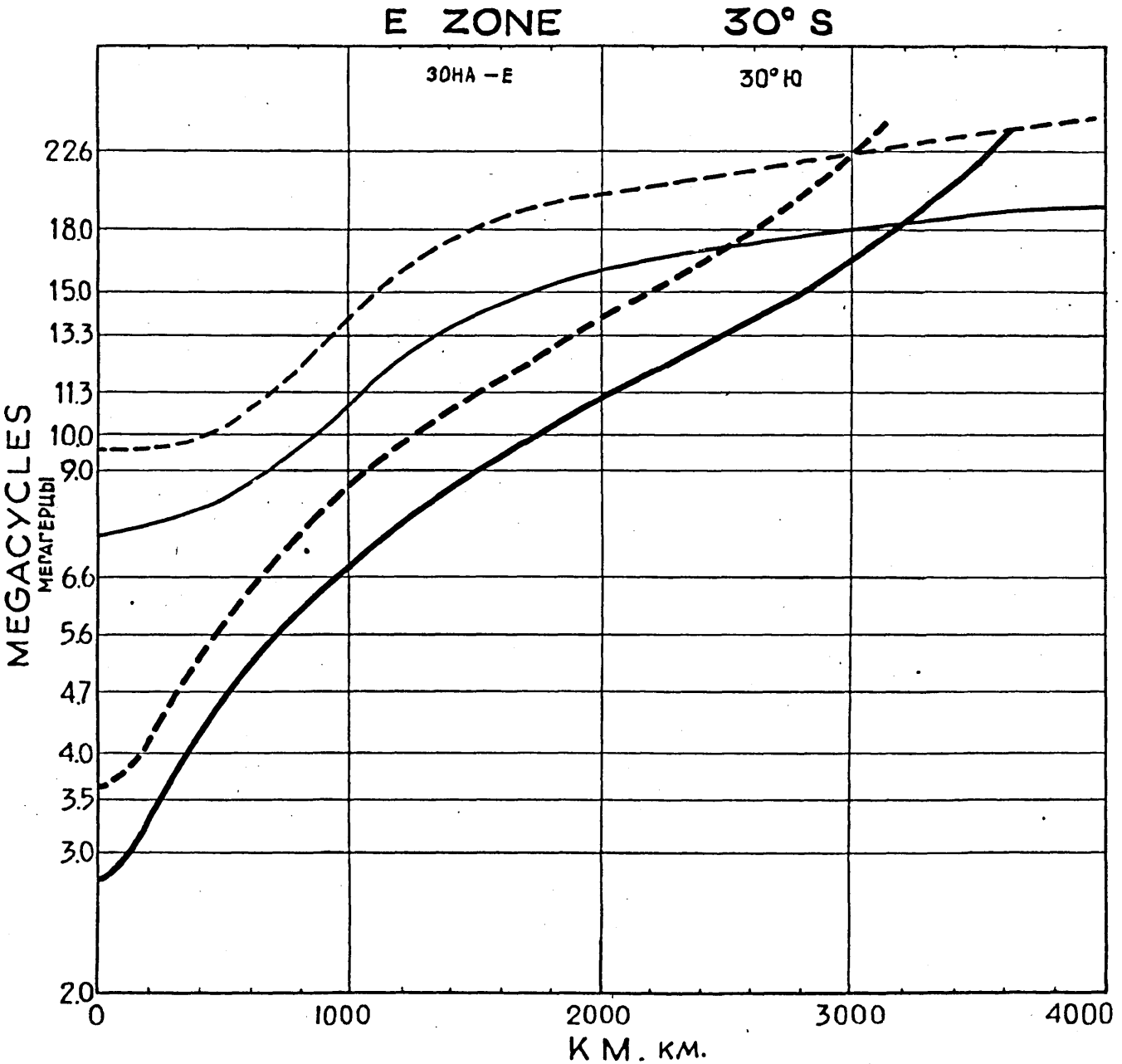

E ZONE
30° S
ЗОНА – E
30° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАГЕРЦЫ
0
1000
2000
3000
4000
K M. км.

Fig. 71 Рис. 71

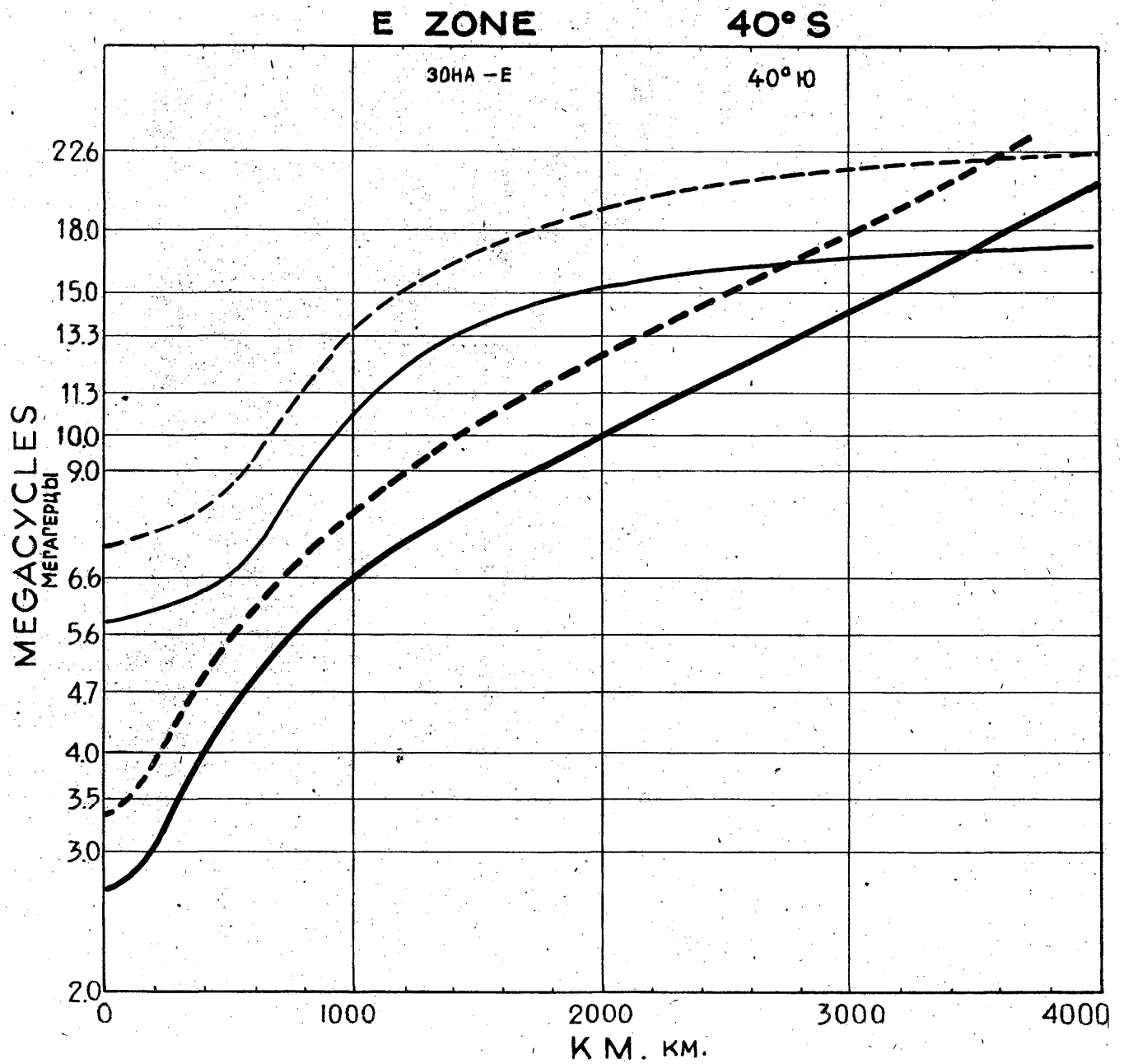

E ZONE
40° S
ЗОНА – Е
40° Ю
22.6
18.0
15.0
13.3
11.3
10.0
9.0
6.6
5.6
4.7
4.0
3.5
3.0
2.0
MEGACYCLES
МЕГАПЕРИОДЫ
0
1000
2000
3000
4000
K M. км.

Fig. 72 Рис. 72

Fig. 73. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

4 Mc/s. Station réceptrice au point où le soleil est au zenith. Stations émettrices situées dans des directions quelconques.

Fig. 73. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

4 Mc/s. Receiving station at the subsolar point. Transmitting station located in any directions.

Fig. 73. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

4 Mc/s. Estación receptora en el punto subsolar. Las estaciones de transmisión emplazadas en cualquier dirección.

Рис. 73. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

4 мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.

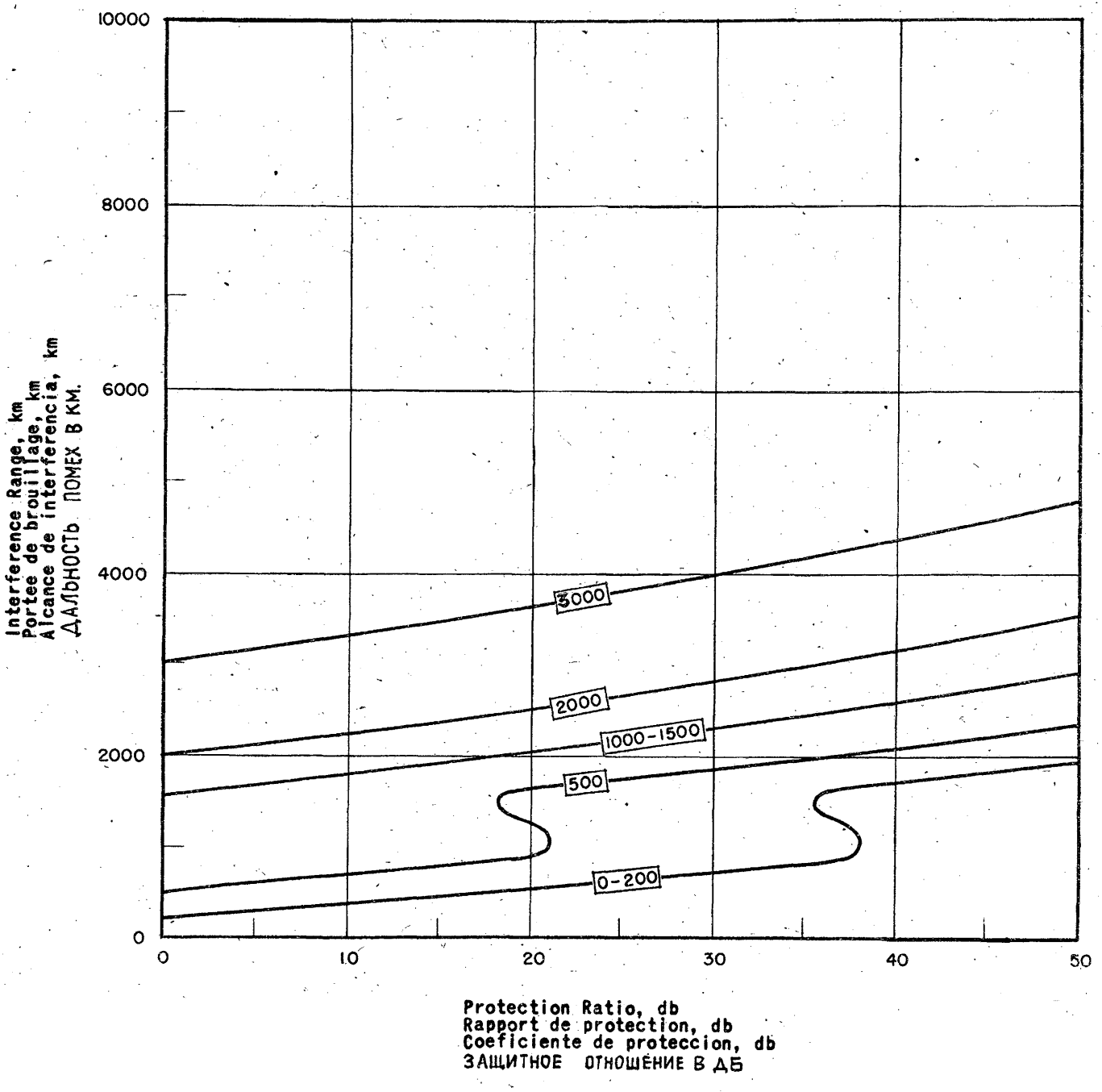

10000
8000
6000
4000
2000
0
0
10
20
30
40
50
3000
2000
1000-1500
500
0-200
Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 73 Рис. 73

Fig. 74. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

4 Mc/s. Station réceptrice à 60° du point où le soleil est au zenith. Stations émettrices dans une direction faisant un angle droit avec celle du point où le soleil est au zenith.

Fig. 74. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

4 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 74. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

4 Mc/s. Estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en angulos rectos respecto a la dirección del punto subsolar.

Рис. 74. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

4 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.

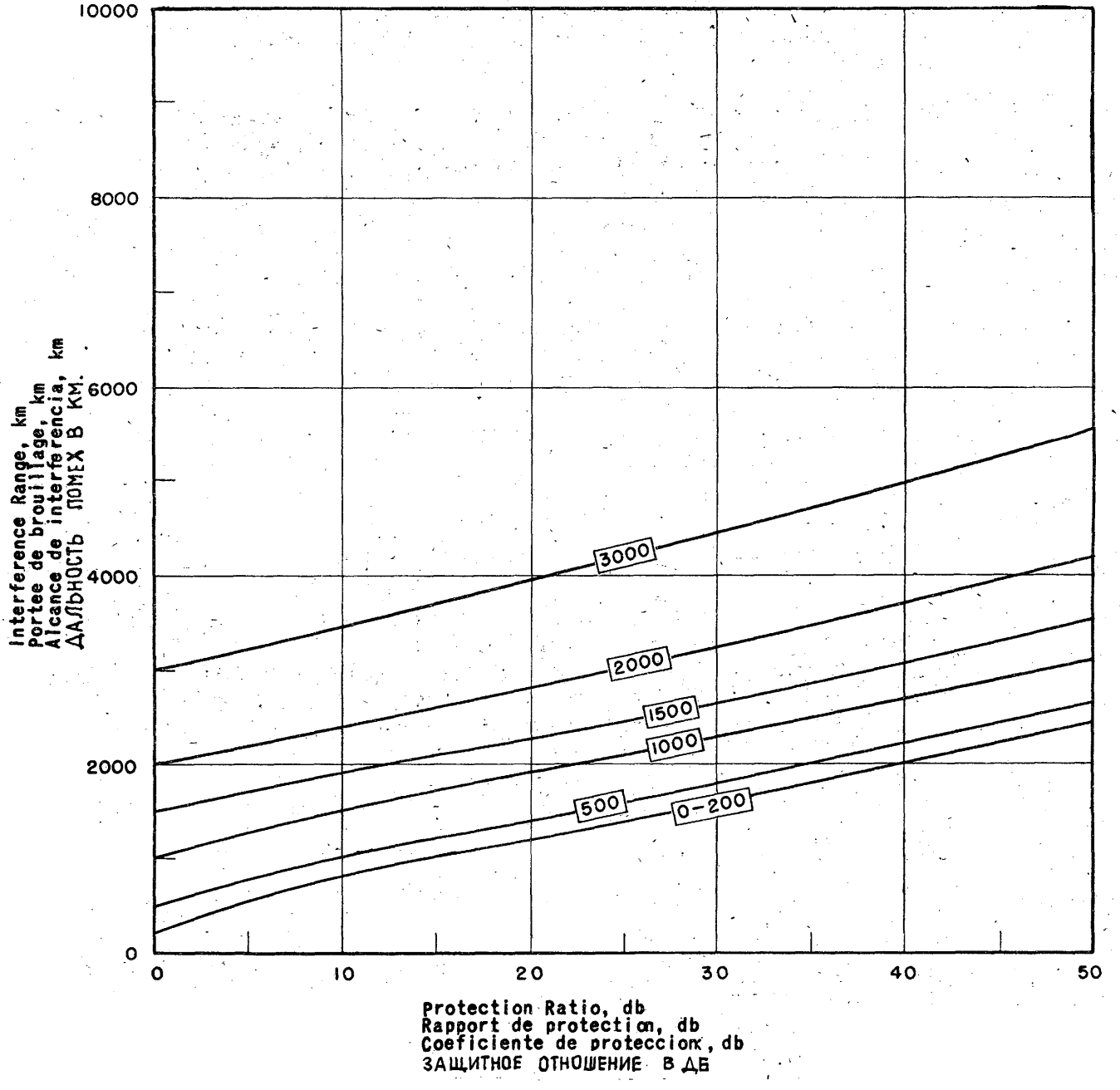

10000
8000
6000
4000
2000
0
0
10
20
30
40
50
3000
2000
1500
1000
500
0-200
Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 74 Рис. 74

Fig. 75. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

4 Mc/s. Station réceptrice à 60° du point où le soleil est au zenith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 75. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

4 Mc/s. Receiving station 60° from the subsolar point . Transmitting stations located in the direction of the day-night line.

Fig. 75. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

4 Mc/s. La estación receptora a 60° del punto subsolar. las estaciones transmisoras emplazadas en la dirección de la linea día-noche.

Рис. 75. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

4 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.

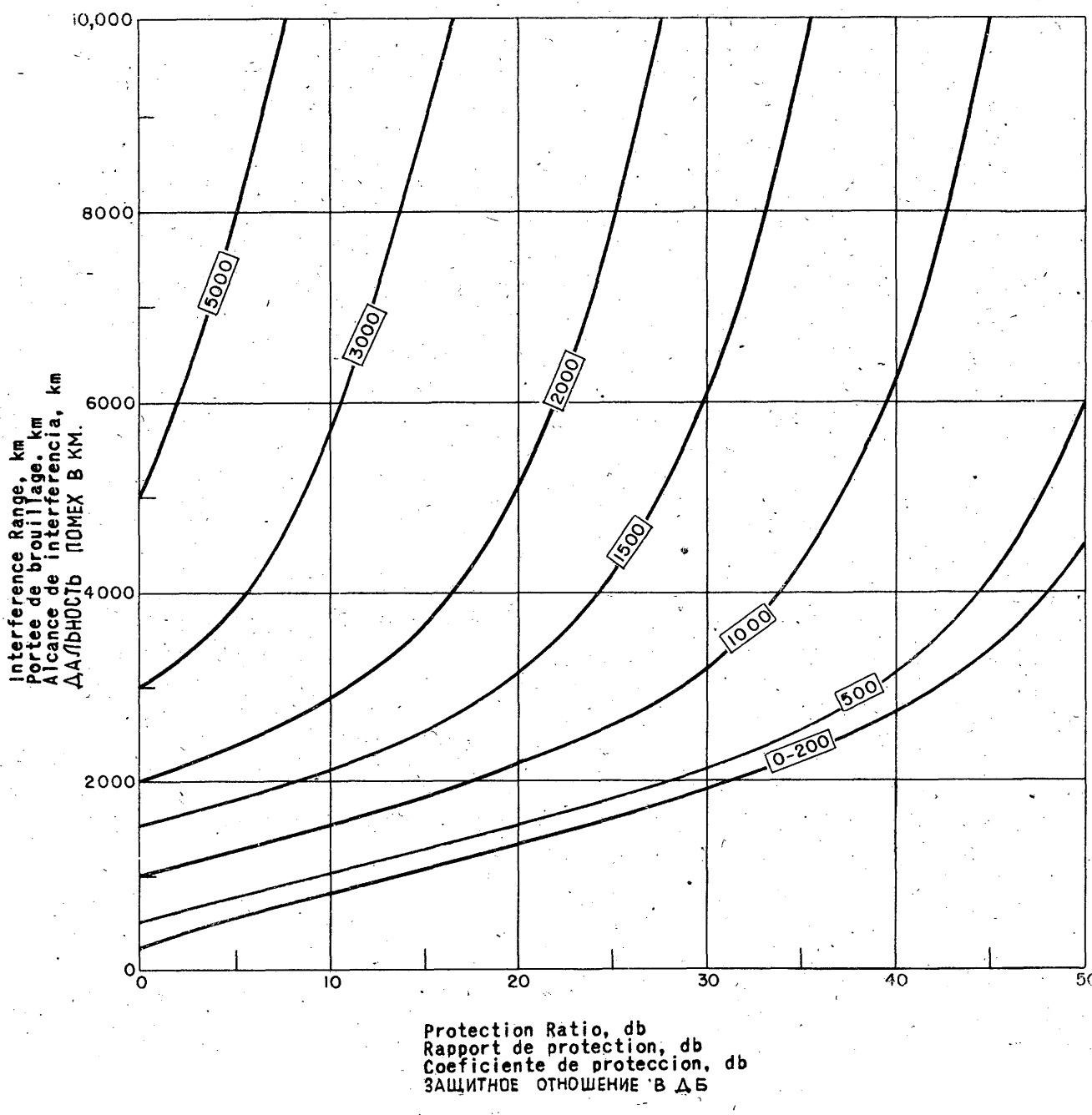

10,000
8000
6000
4000
2000
0
0
10
20
30
40
50
5000
3000
2000
1500
1000
500
0-200
Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 75 Рис. 75

Fig. 76. Portées de brouillage en fonction de la portée utile et du rapport de protection pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

4 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zénith.

Fig. 76. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

4 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 76. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de Actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

4 Mc/s. La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 76. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

4 мгц. Приемная станция на линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.

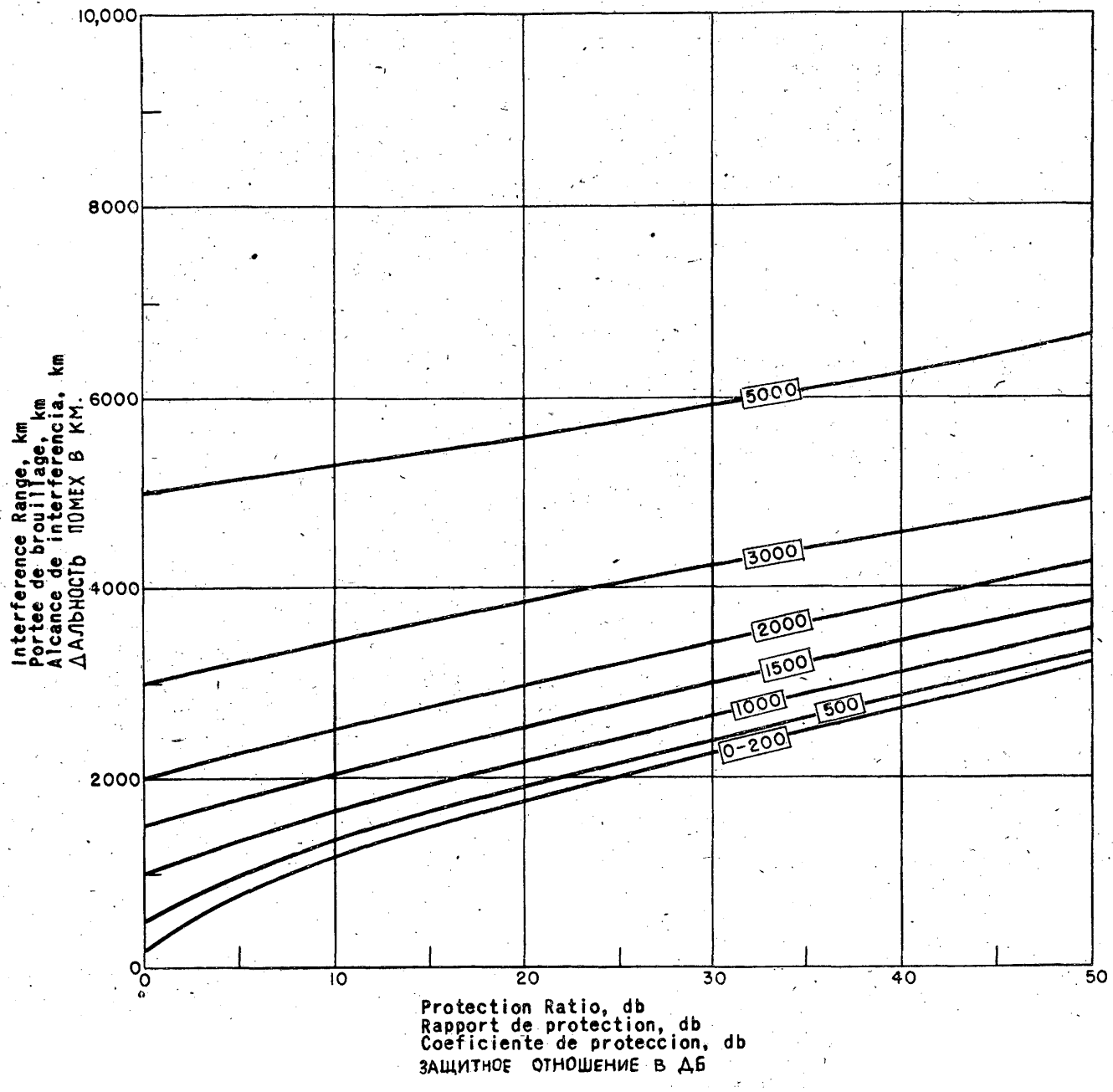

10,000
8000
6000
4000
2000
0
0
10
20
30
40
50
5000
3000
2000
1500
1000
500
0-200
Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 76 Рис. 76

Fig. 77. Portées de brouillage en fonction de la portée utile et du rapport de protection pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

6 Mc/s. Station réceptrice au point où le soleil est au zénith. Stations émettrices situées dans des directions quelconques.

Fig. 77. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

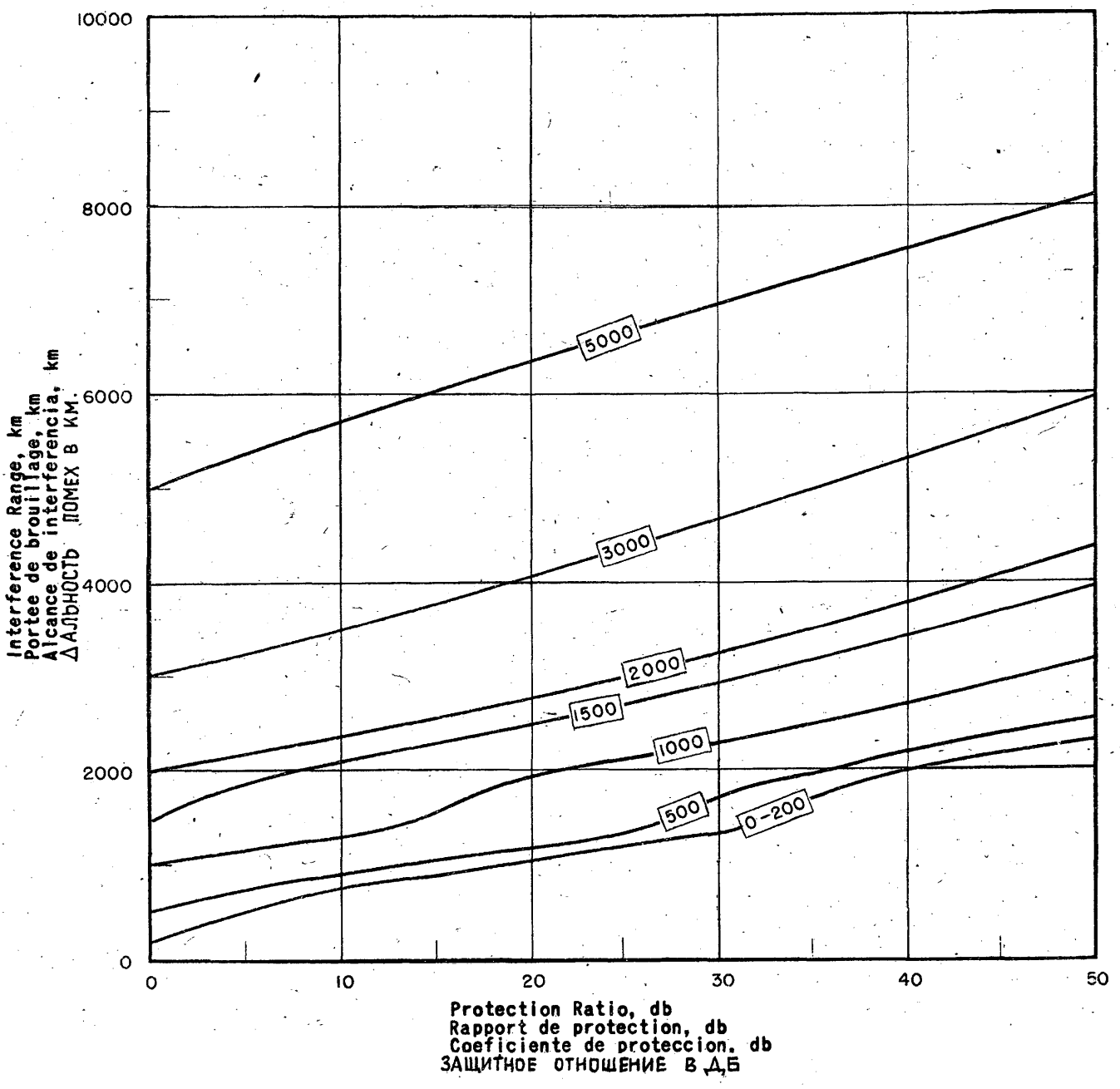
6 Mc/s. Receiving station at the subsolar point. Transmitting stations located in any directions.

Fig. 77. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

6 Mc/s. Estación receptora en el punto subsolar. Estaciones transmisoras situadas en todas direcciones.

Рис. 77. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

6 мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 77 Рис. 77

Fig. 78. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

6 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans une direction faisant un angle droit avec celle du point où le soleil est au zénith.

Fig. 78. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

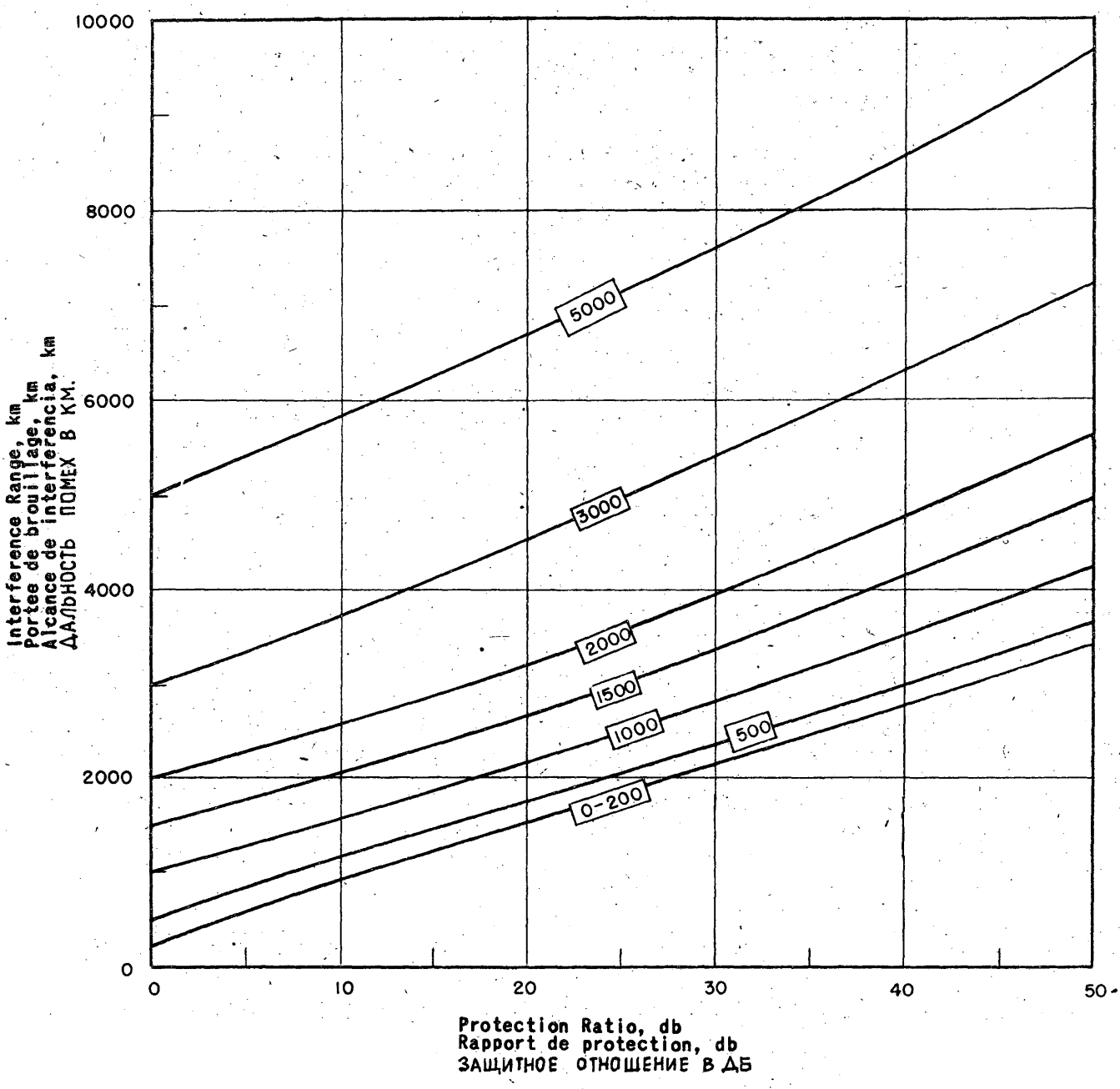
6 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 78. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

6 Mc/s. Estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en ángulos rectos respecto a la dirección del punto subsolar.

Рис. 78. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

6 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 78 Рис. 78

Fig. 79. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

6 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 79. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

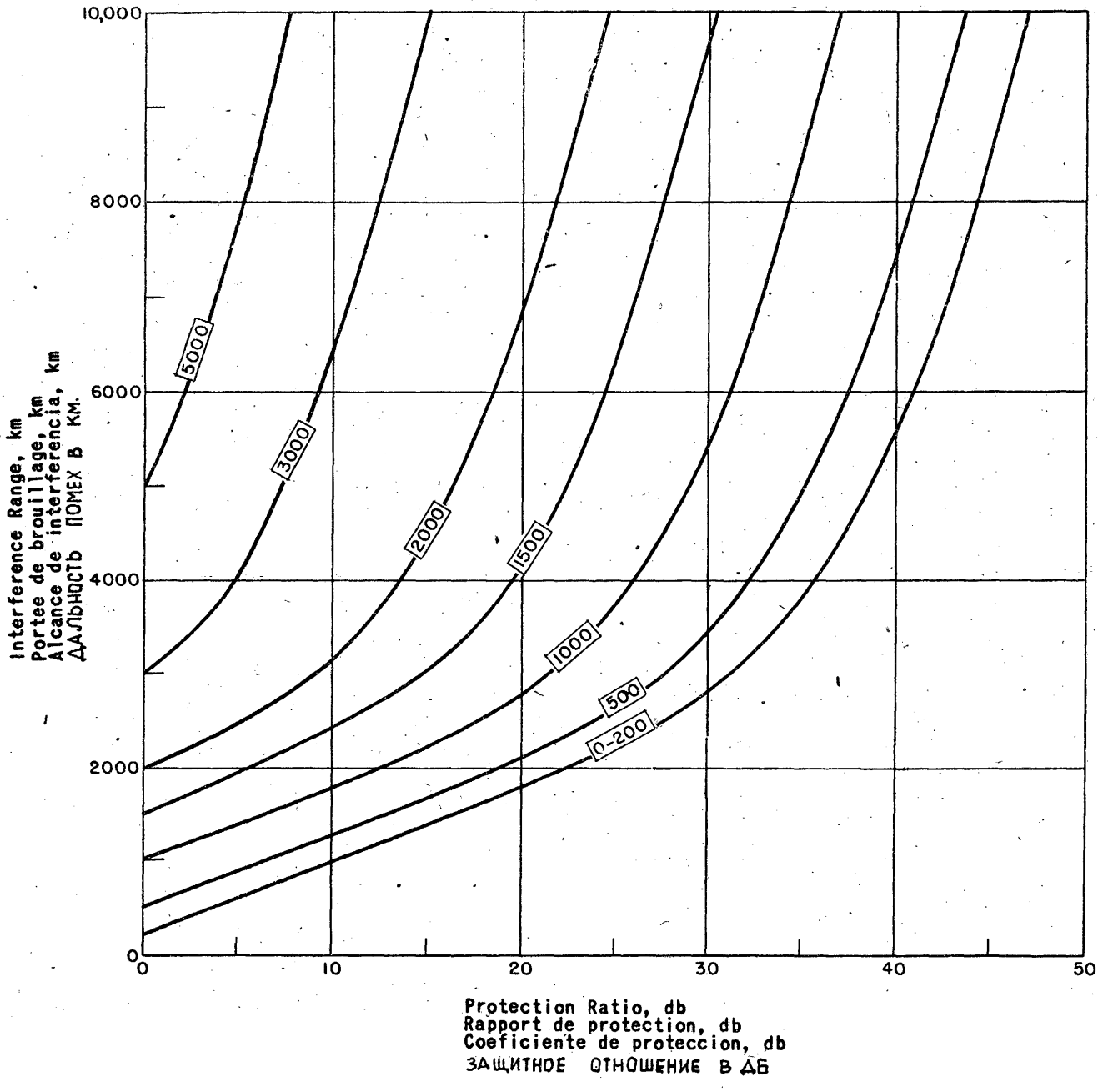
6 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located in the direction of the day-night line.

Fig. 79. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

6 Mc/s. La estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en la dirección de la línea día-noche.

Рис. 79. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

6 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 79 Рис. 79

Fig. 80. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

6 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zenith.

Fig. 80. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

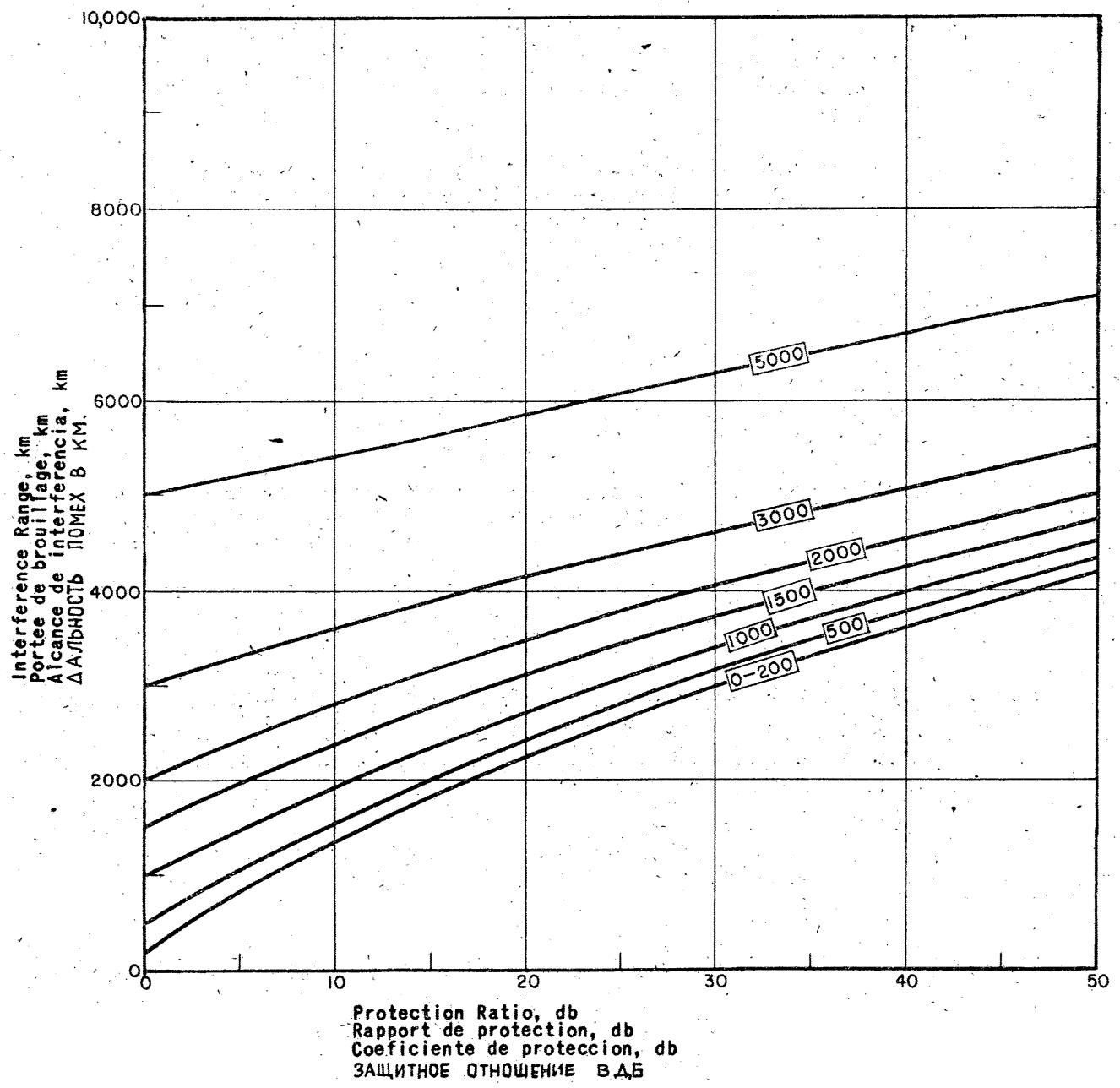
6 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 80. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

6 Mc/s La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 80. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

6 мгц. Приемная станция на линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 80 Рис.80

Fig. 81. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

10 Mc/s. Station réceptrice au point où le soleil est au zénith. Stations émettrices situées dans des directions quelconques.

Fig. 81. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

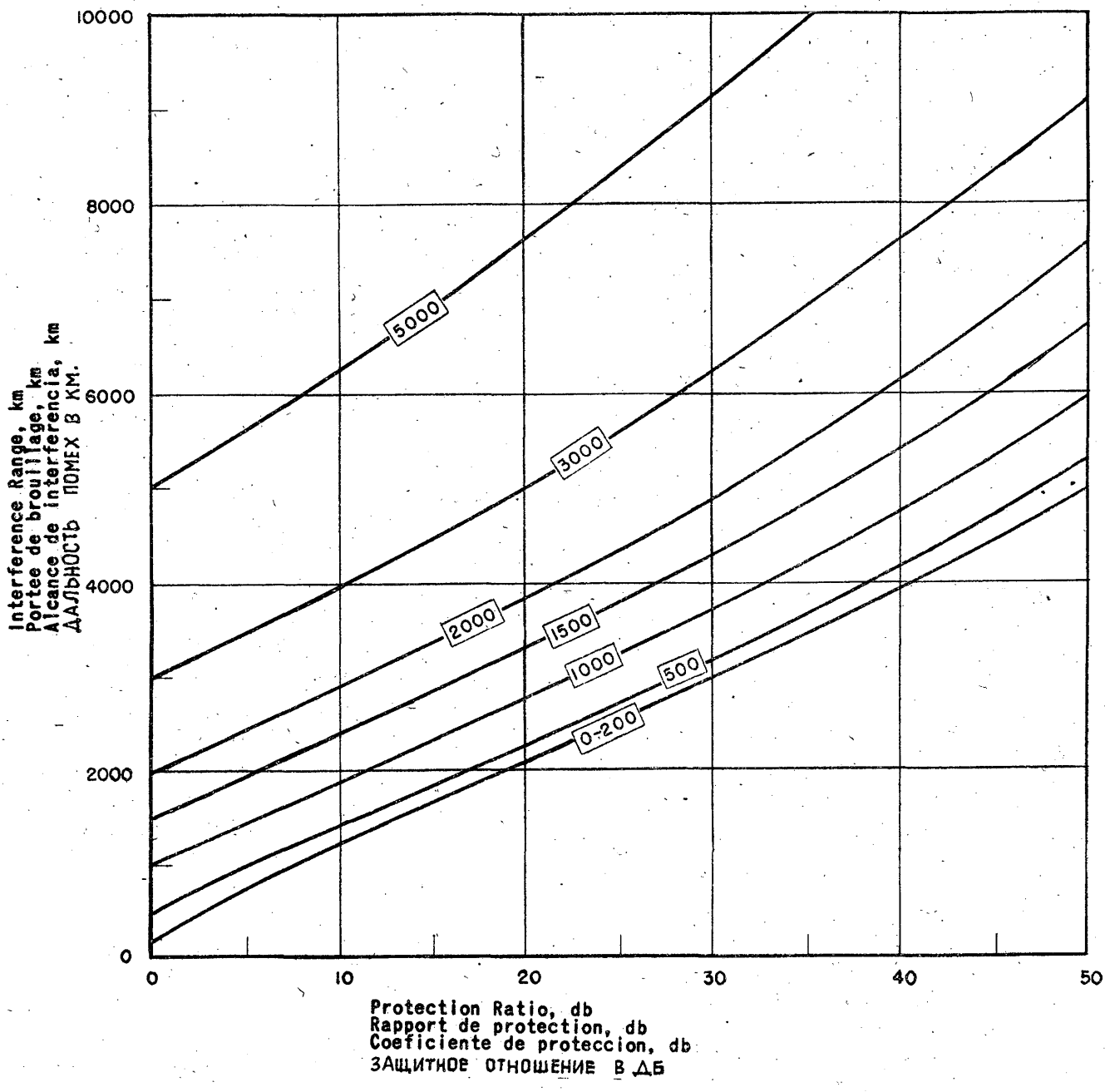
10 Mc/s. Receiving station at the subsolar point. Transmitting stations located in any directions.

Fig. 81. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

10 Mc/s. Estación receptora en el punto subsolar. Las estaciones de transmisión emplazadas en cualquier dirección.

Рис. 81. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

10 мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 81 Рис. 81

Fig. 82. Portées de brouillage en fonction de la portée utile et du rapport de protection pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

10 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans une direction faisant un angle droit avec celle du point où le soleil est au zénith.

Fig. 82. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

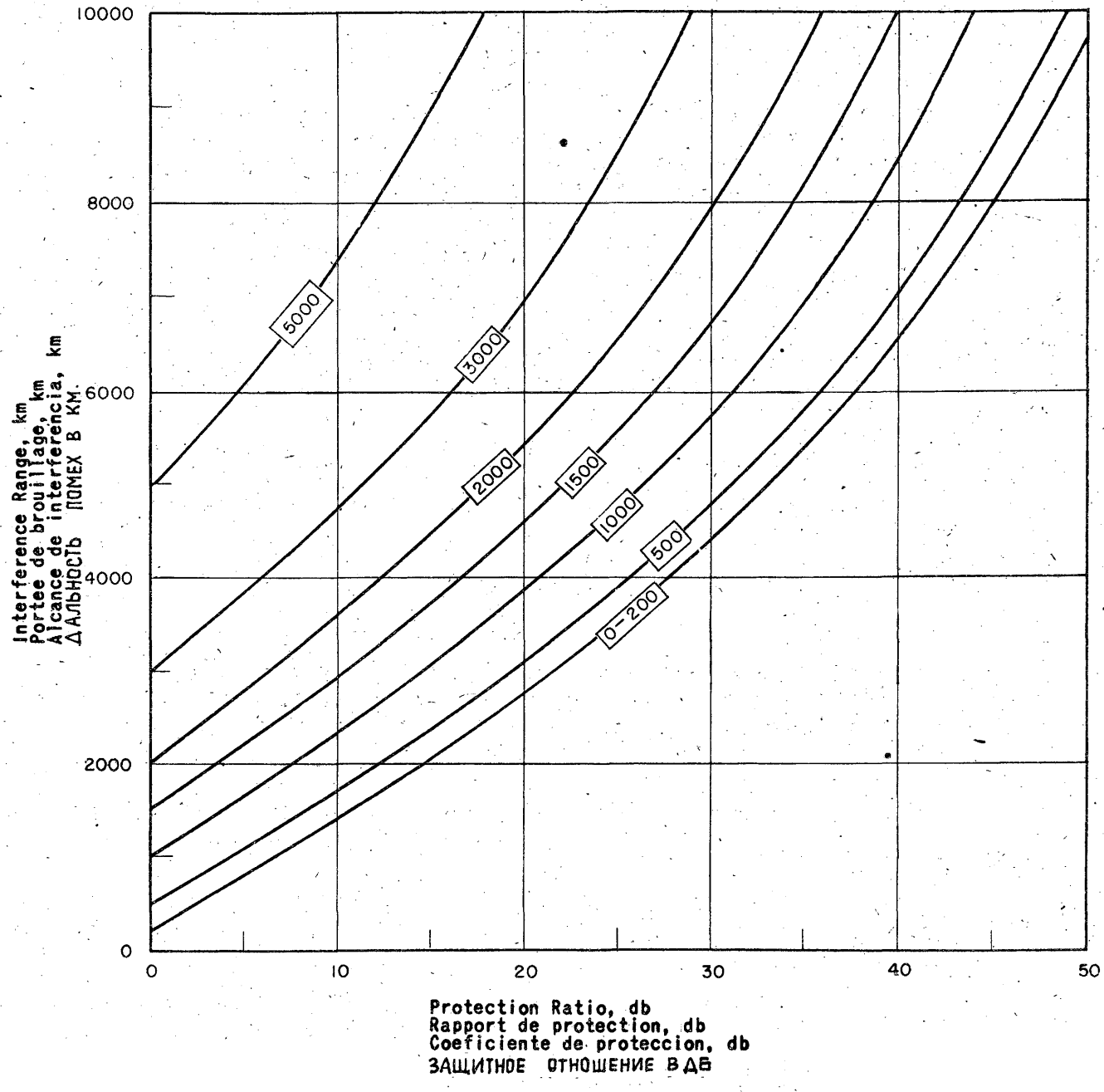
10 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 82. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

10 Mc/s. Estación receptora a 60° delpunto subsolar. Las estaciones transmisoras emplazadas en ángulos rectos respecto a la dirección del punto subsolar.

Рис. 82. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

10 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 82 Рис. 82

Fig. 83. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

10 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 83. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

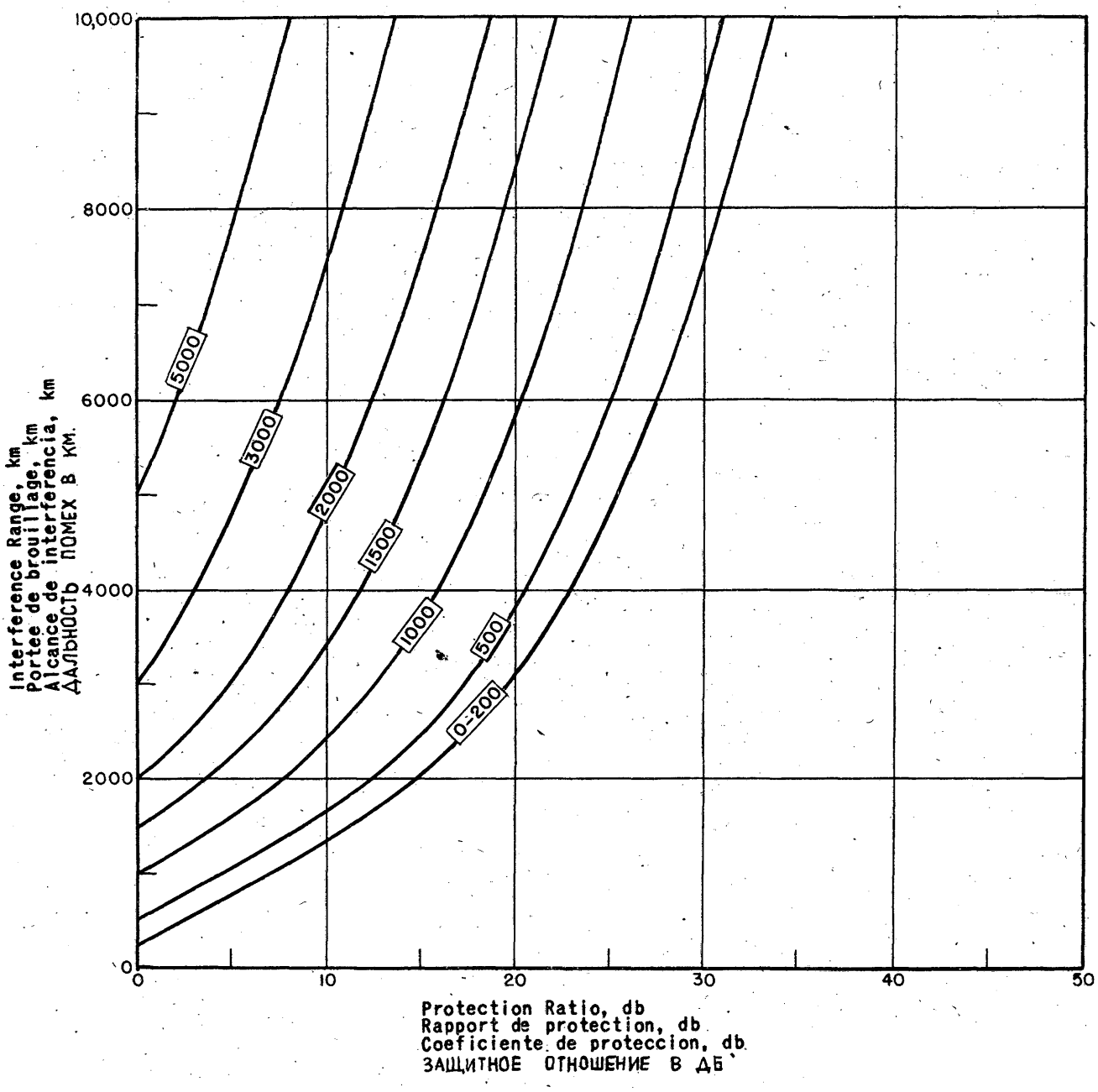
10 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located in the direction of the day-night line

Fig. 83. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

10 Mc/s. La estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en la dirección de la línea día-noche.

Рис. 83. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

10 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 83 Рис. 83

Fig. 84. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

10 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zénith.

Fig. 84. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

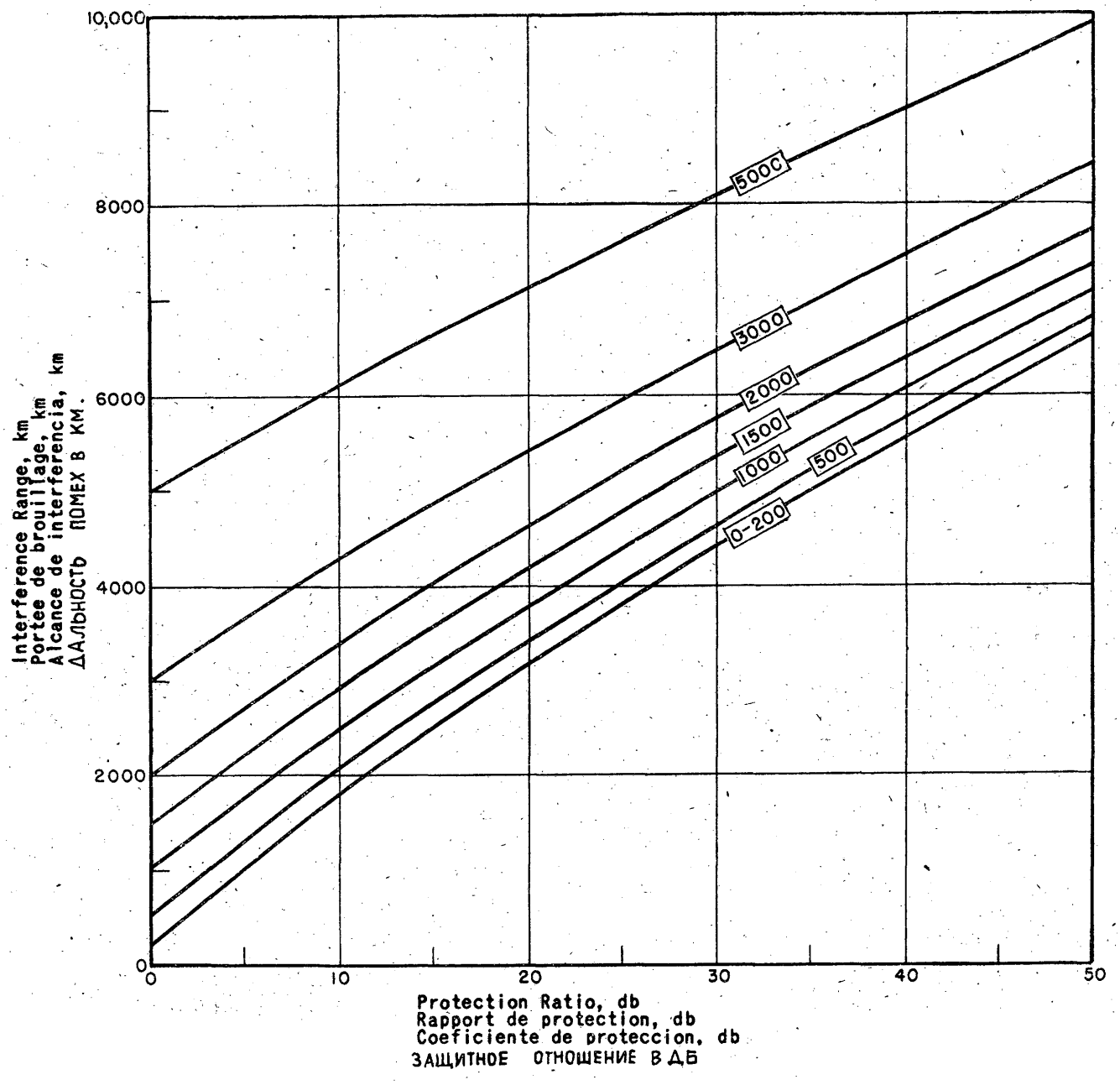
10 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 84. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

10 Mc/s. La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 84. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

10. мгц. Приемная станция на линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig.84 Рис.84

Fig. 85. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

15 Mc/s. Station réceptrice au point où le soleil est au zénith. Stations émettrices situées dans des directions quelconques.

Fig. 85. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

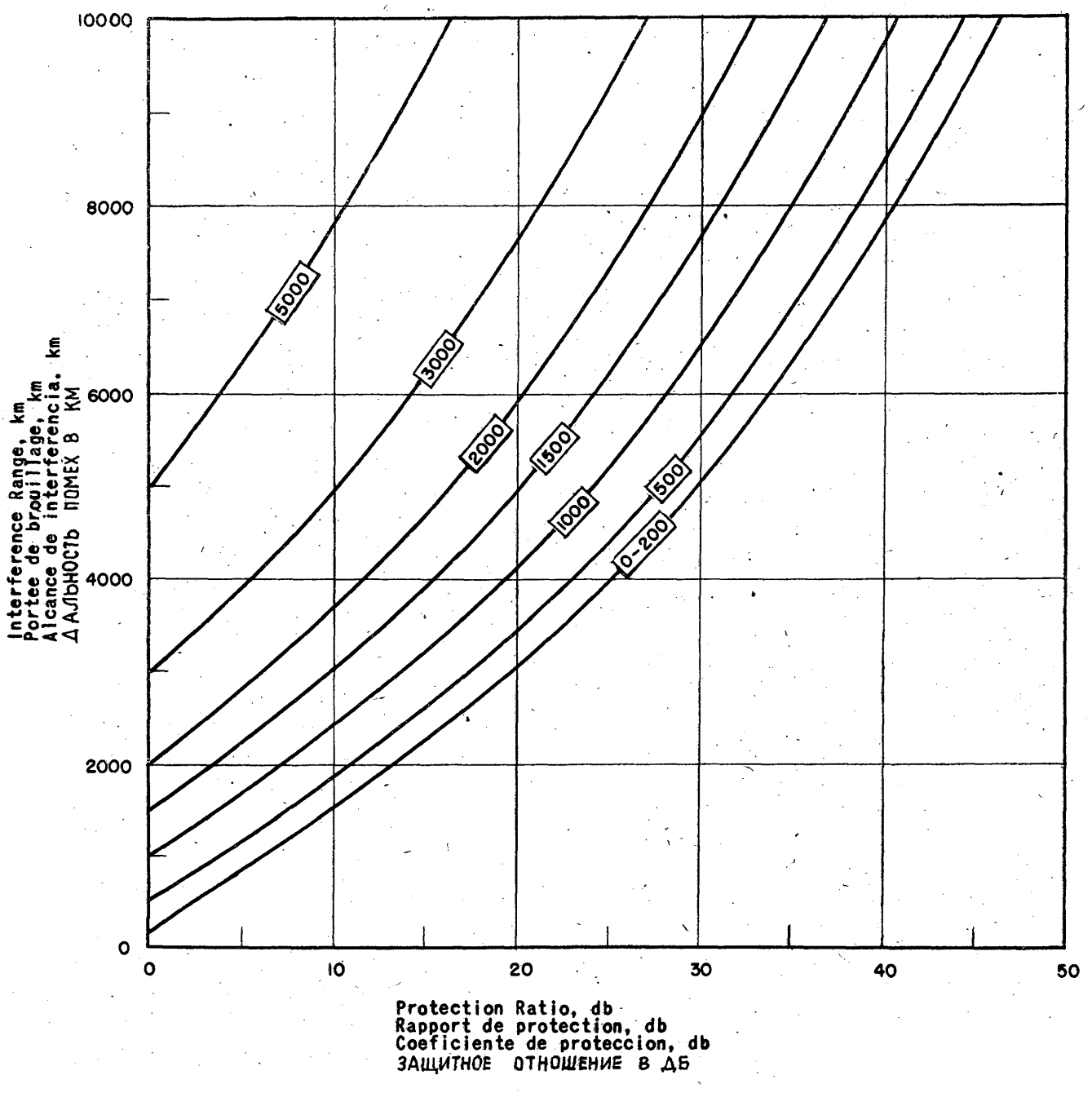
15 Mc/s. Receiving station at the subsolar point. Transmitting stations located in any directions.

Fig. 85. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

15 Mc/s. Estación receptora en el punto subsolar. Las estaciones de transmisión emplazadas en cualquier dirección.

Рис. 85. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

15 мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig.85 Рис.85

Fig. 86. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

15 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans une direction faisant un angle droit avec celle du point où le soleil est au zénith.

Fig. 86. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

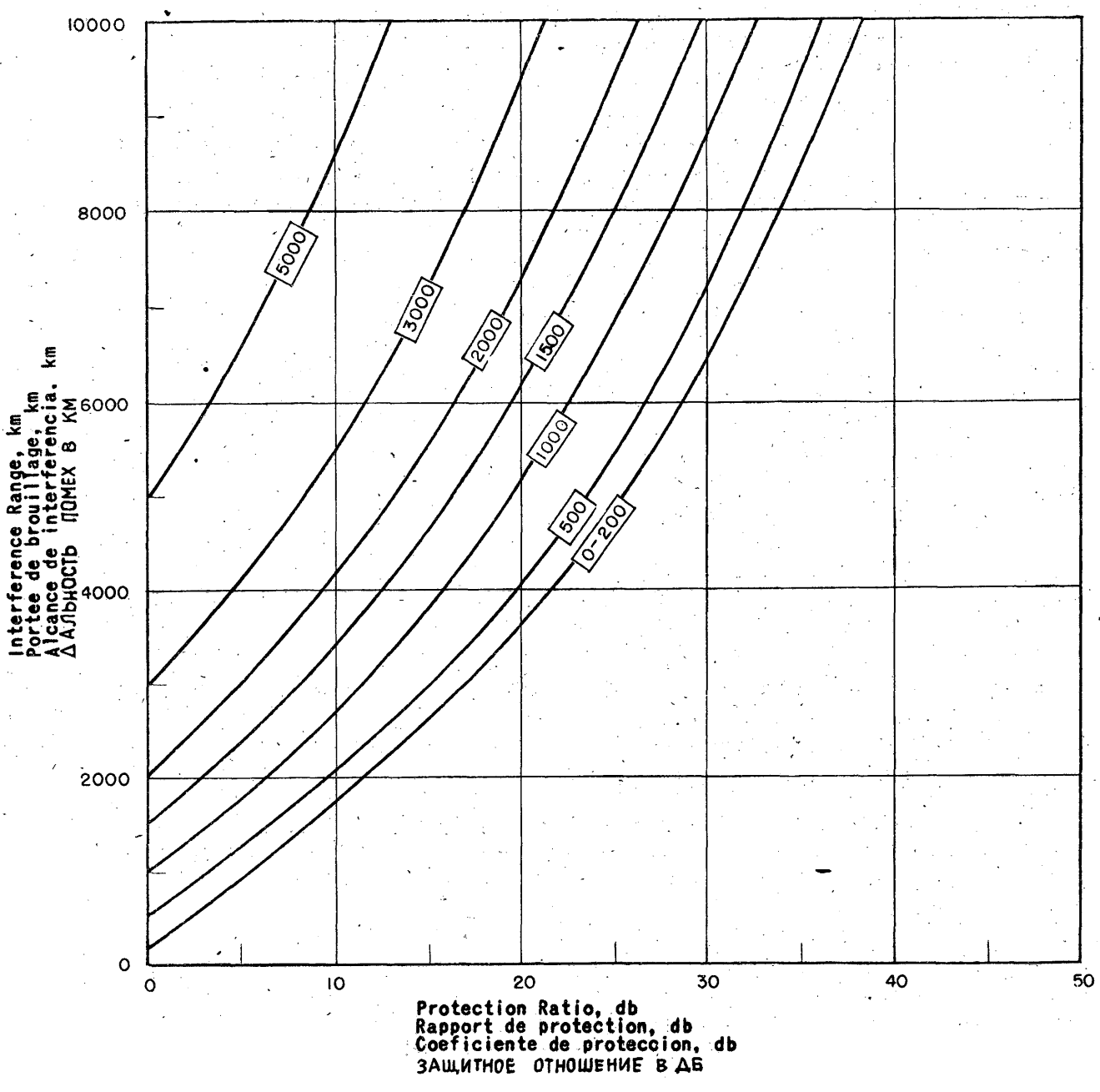
15 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 86. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

15 Mc/s. Estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en ángulos rectos respecto a la dirección del punto subsolar.

Рис. 86. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

15 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
Дальность помех в км
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
Защитное отношение в дБ

Fig. 86 Рис. 86

Fig. 87. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

15 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 87. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

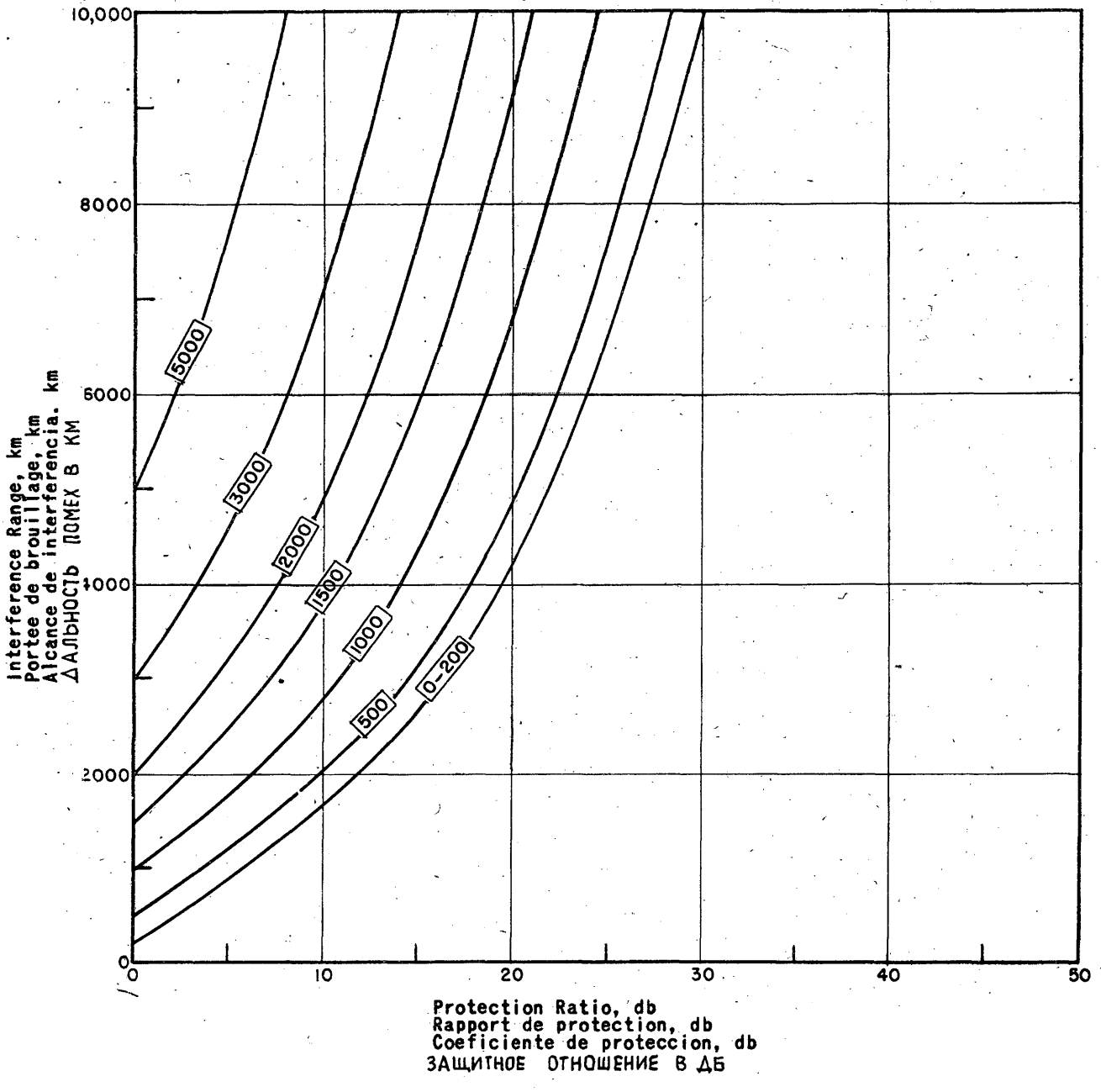
15 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located in the direction of the day-night line.

Fig. 87. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

15 Mc/s. La estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en la dirección de la línea día-noche.

Рис. 87. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

15. мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 87 Рис.87

Fig. 88. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

15 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zénith.

Fig. 88. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

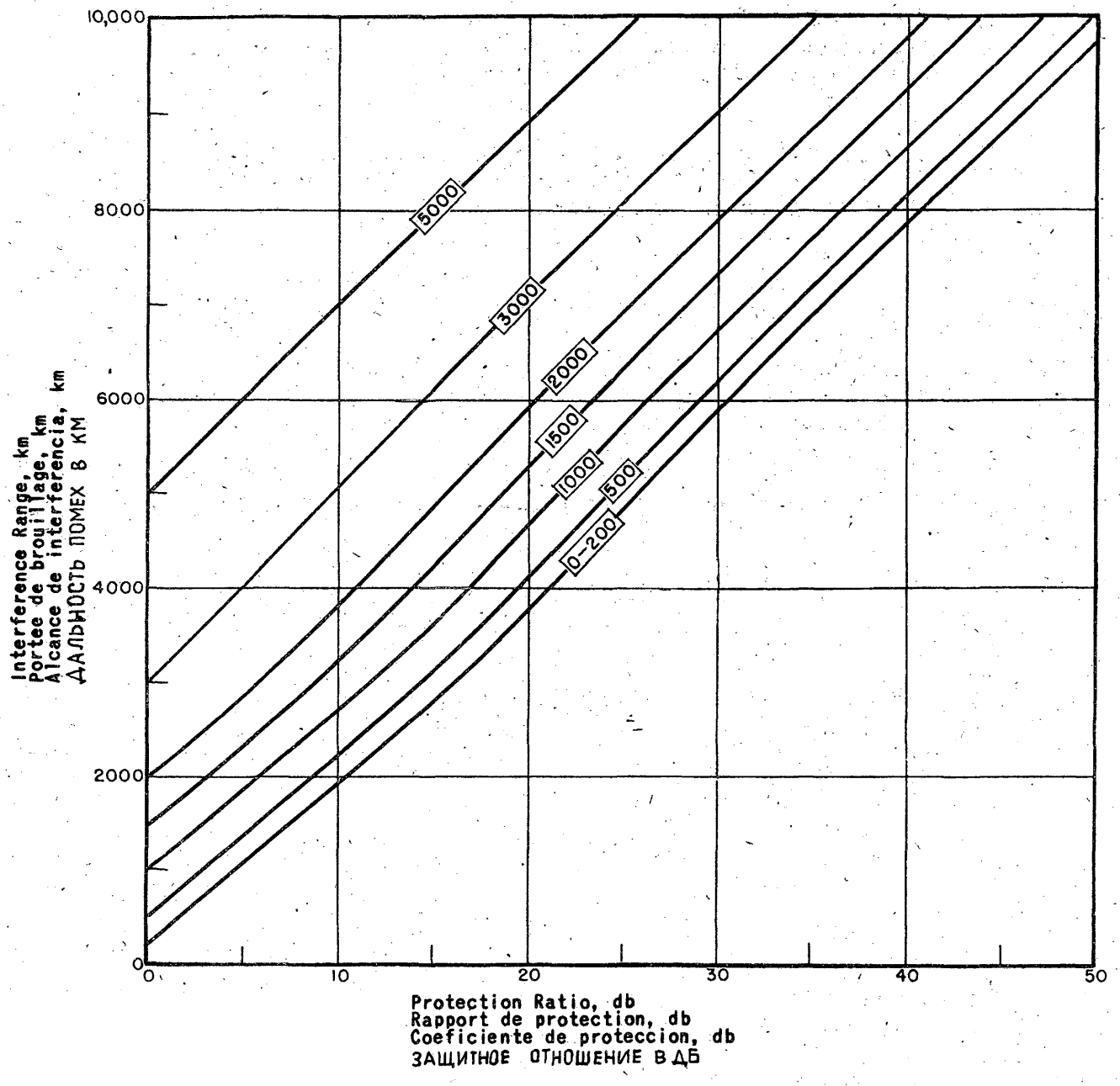
15 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 88. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

15 Mc/s. La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 88. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

15 мгц. Приемная станция на линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 88 Рис.88

Fig. 89. Portées de brouillage en fonction de la portée utile et du rapport de protection pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

20 Mc/s. Station réceptrice au point où le soleil est au zénith. Stations émettrices situées dans des directions quelconques.

Fig. 89. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

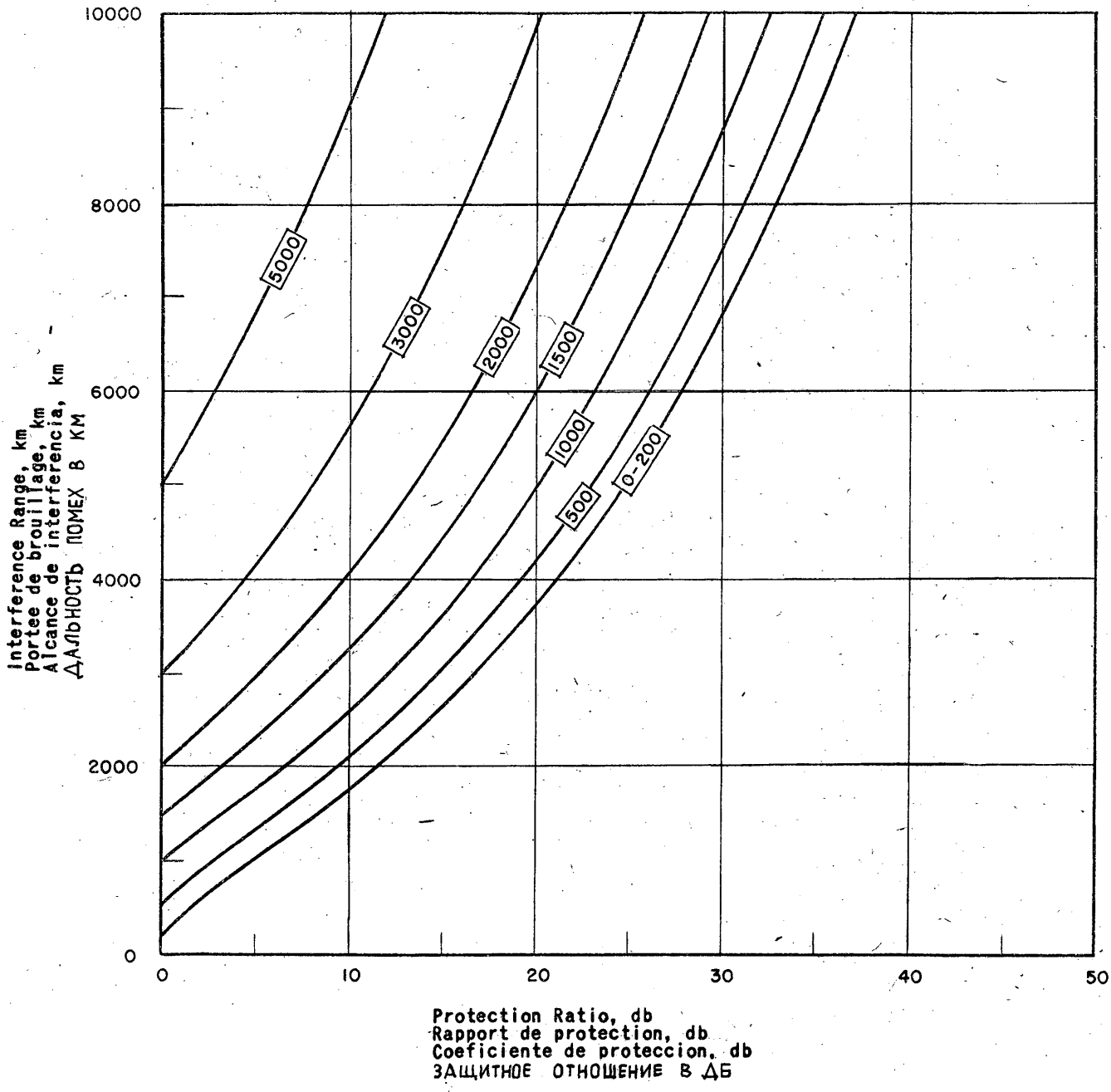
20 Mc/s. Receiving station at the subsolar point. Transmitting stations located in any directions.

Fig. 89. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad soalr. Los números de las curvas indican la distancia de operación en kilómetros.

20 Mc/s. Estación receptora en el punto subsolar. Las estaciones de transmisión emplazadas en cualquier dirección.

Рис. 89. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

20 мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 89 Рис.89

Fig. 90. Portées de brouillage en fonction de la portée utile et du rapport de protection pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

20 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices dans une direction faisant un angle droit avec celle du point où le soleil est au zénith.

Fig. 90. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

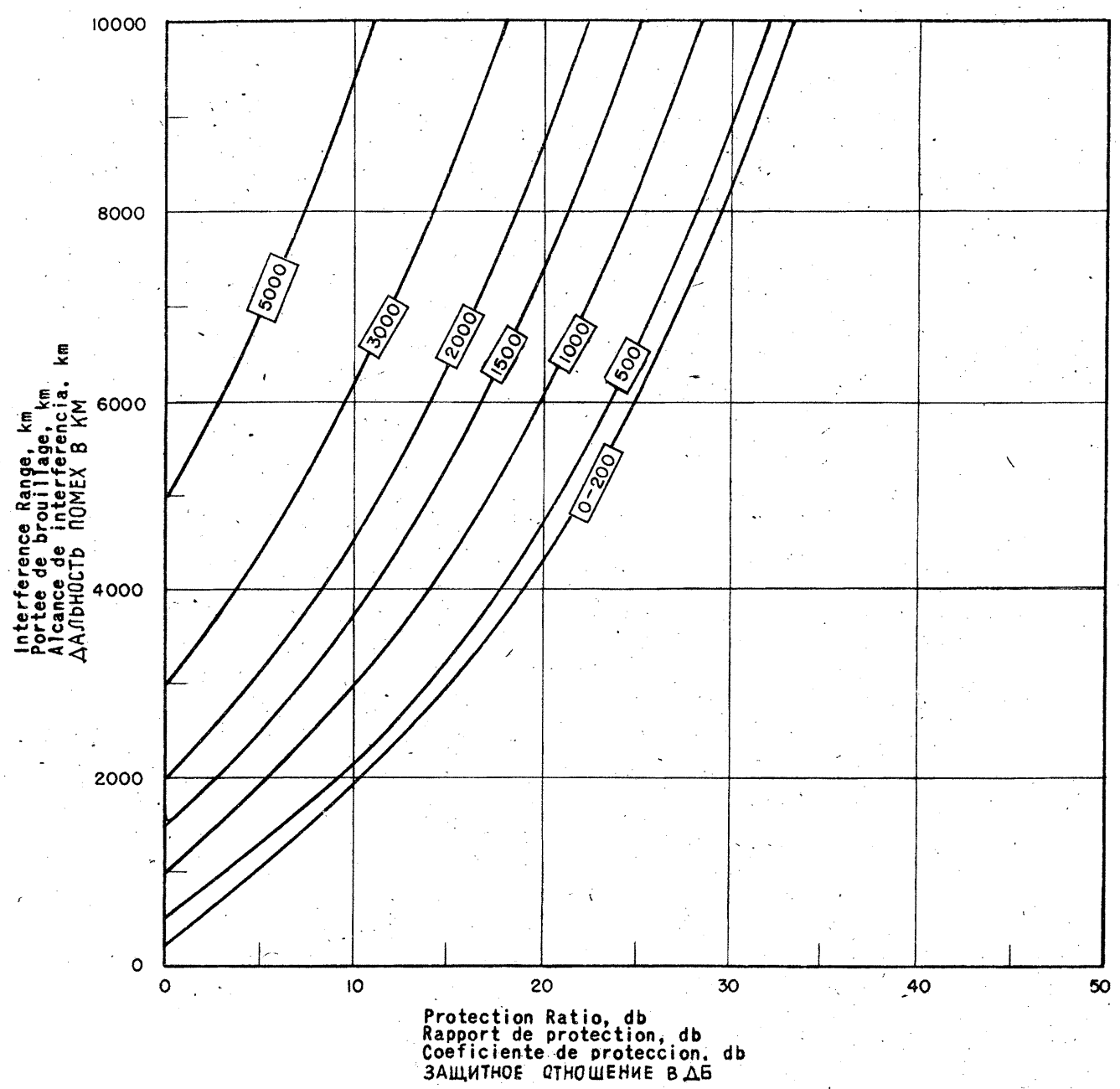
20 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 90 Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

20 Mc/s. Estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en ángulos rectos respecto a la dirección del punto subsolar.

Рис. 90. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

20 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 90 Рис. 90

Fig. 91. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

20 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 91. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

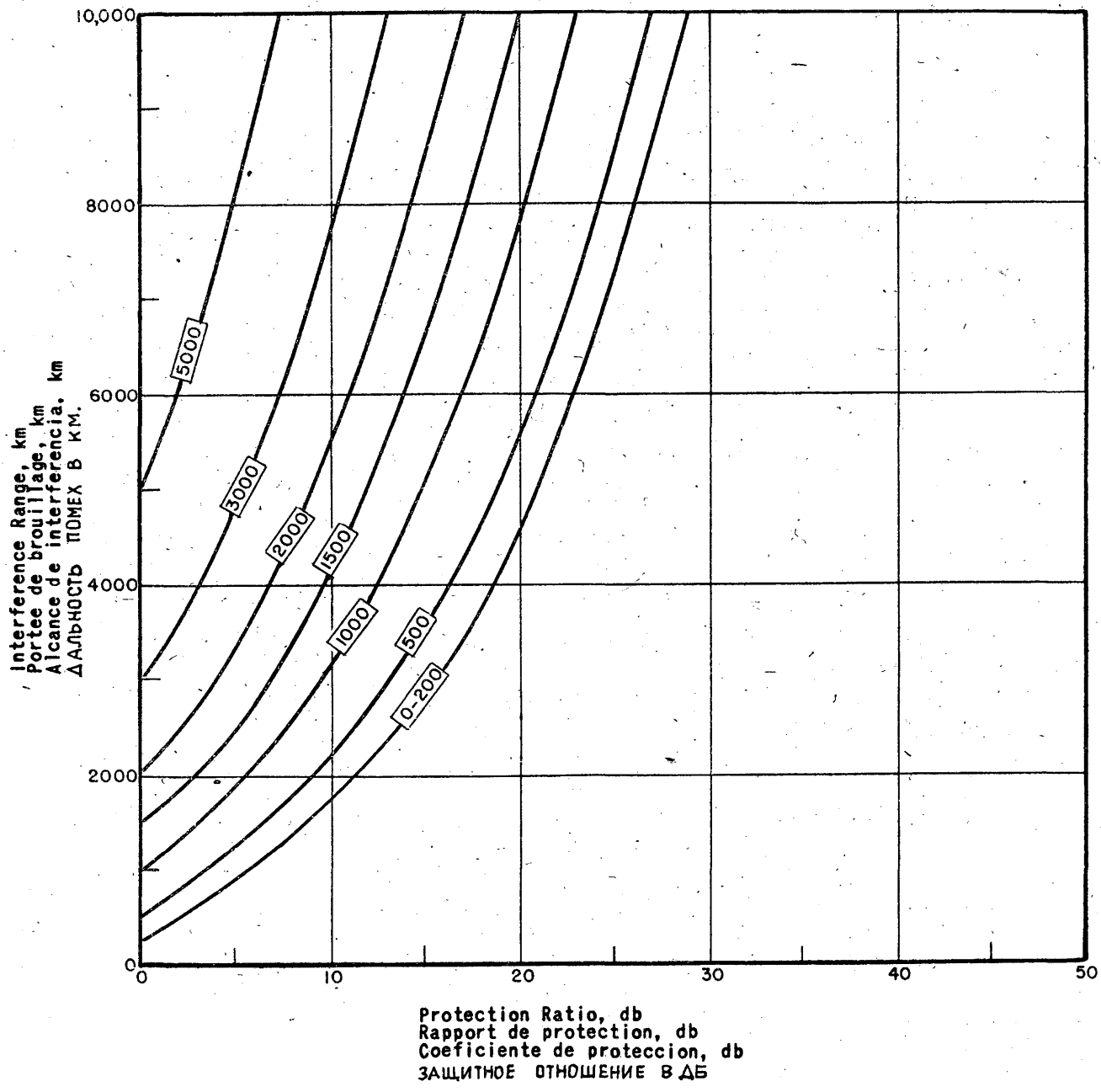
20 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located in the direction of the day-night line.

Fig. 91. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

20 Mc/s. La estación receptora à 60° del punto subsolar. Las estaciones transmisoras emplazadas en la dirección de la línea día-noche.

Рис. 91. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

20 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 91 Рис. 91

Fig. 92. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

20 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zénith.

Fig. 92. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

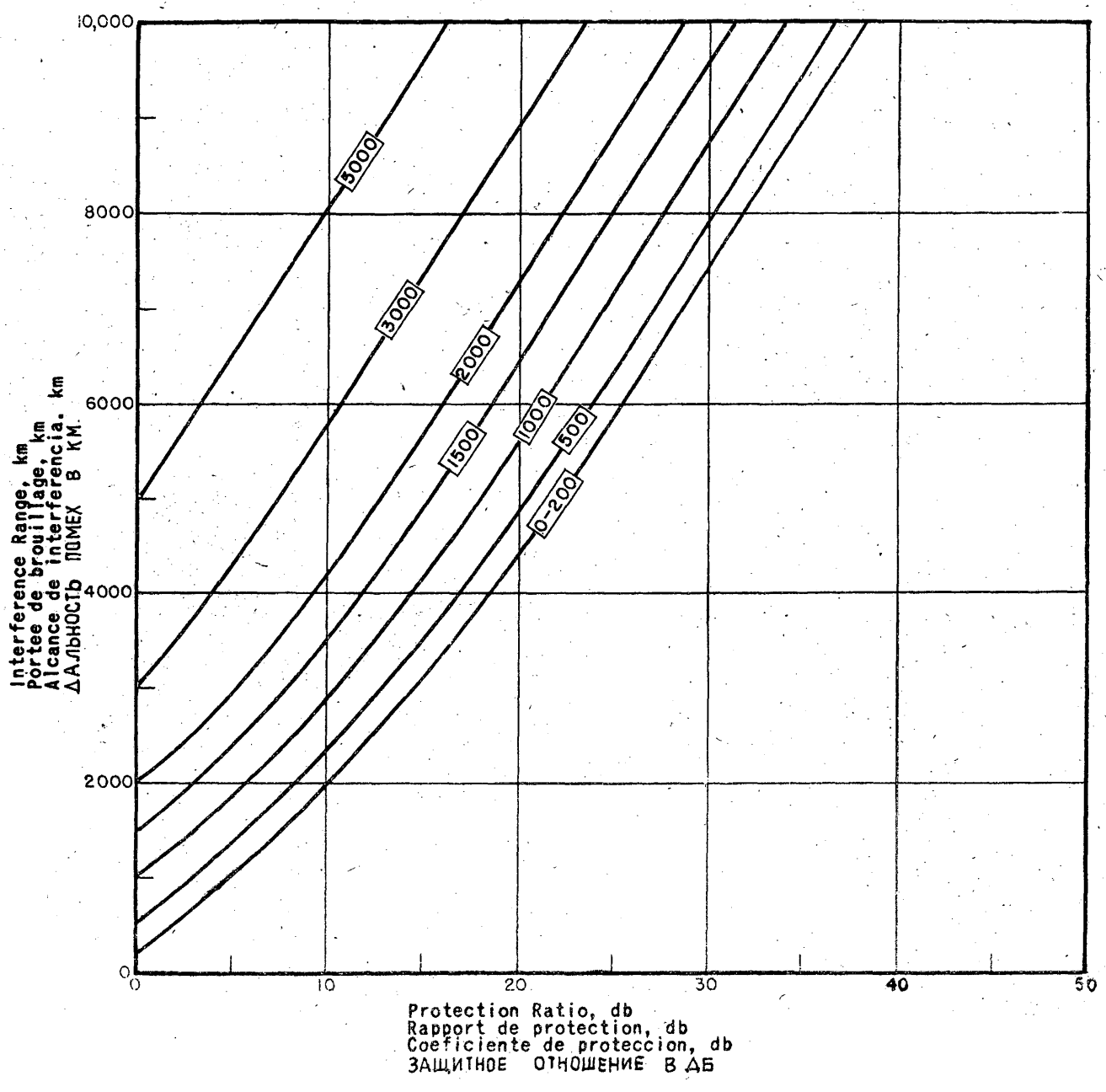
20 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 92. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

20 Mc/s. La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 92. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

20 мгц. Приемная станция на линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 92 Рис. 92

Fig. 93. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

25 Mc/s. Station réceptrice au point où le soleil est au zénith. Stations émettrices situées dans des directions quelconques.

Fig. 93. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

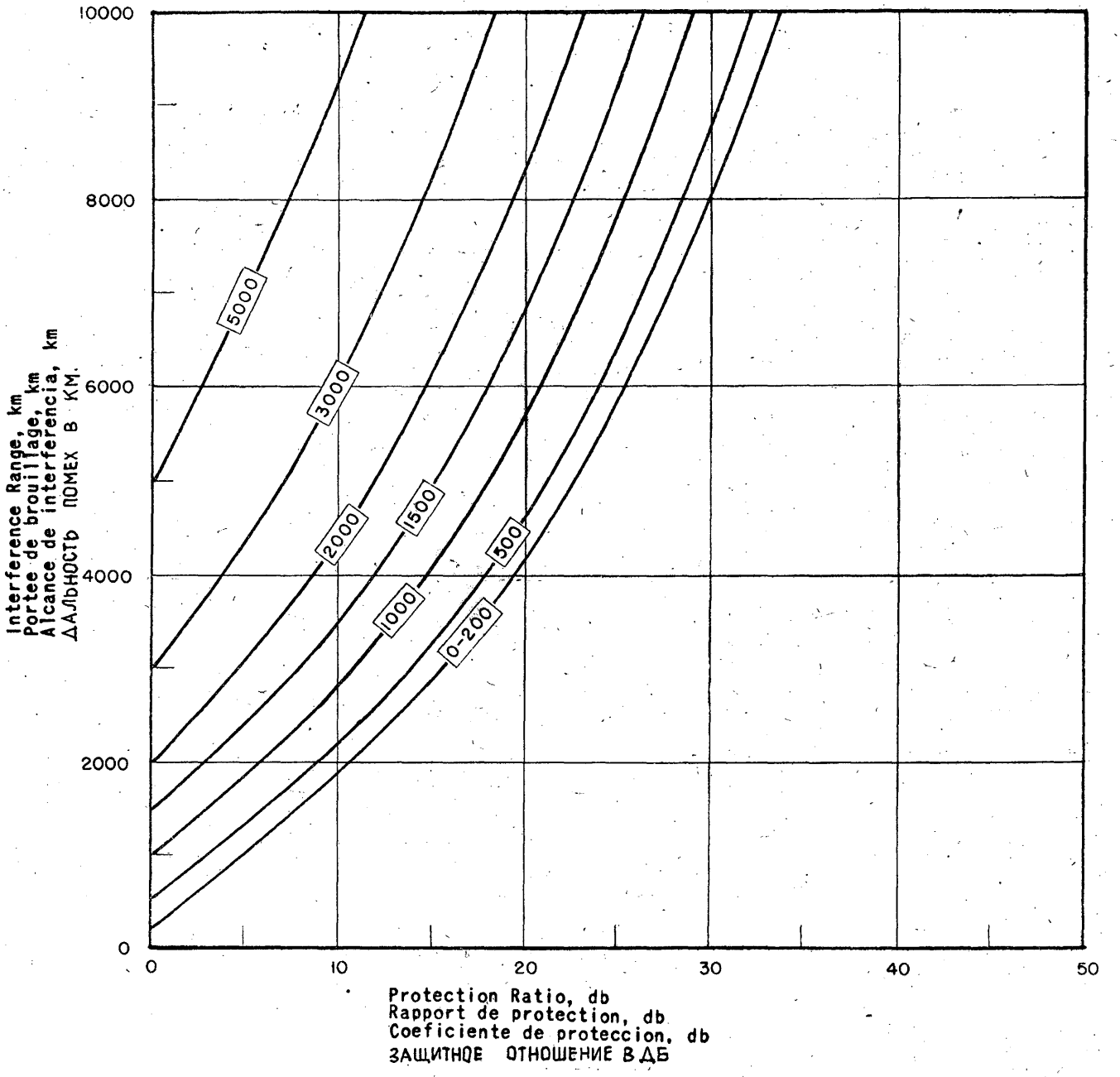
25 Mc/s. Receiving station at the subsolar point. Transmitting stations located in any directions.

Fig. 93. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican le distancia de operación en kilómetros.

25 Mc/s. Estación receptora en el punto subsolar. Las estaciones de transmisión emplazadas en cualquier dirección.

Рис.93. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

25. мгц. Приемная станция в подсолнечной точке. Передающая станция расположена в любом направлении.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ.
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 93 Рис. 93

Fig. 94. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. les chiffres sur les courbes indiquent la portée utile en kilomètres.

25 Mc/s. Station réceptrice à 60° du point où le soleil est au zénith. Stations émettrices dans une direction faisant un angle droit avec celle du point où le soleil est au zénith.

Fig. 94. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

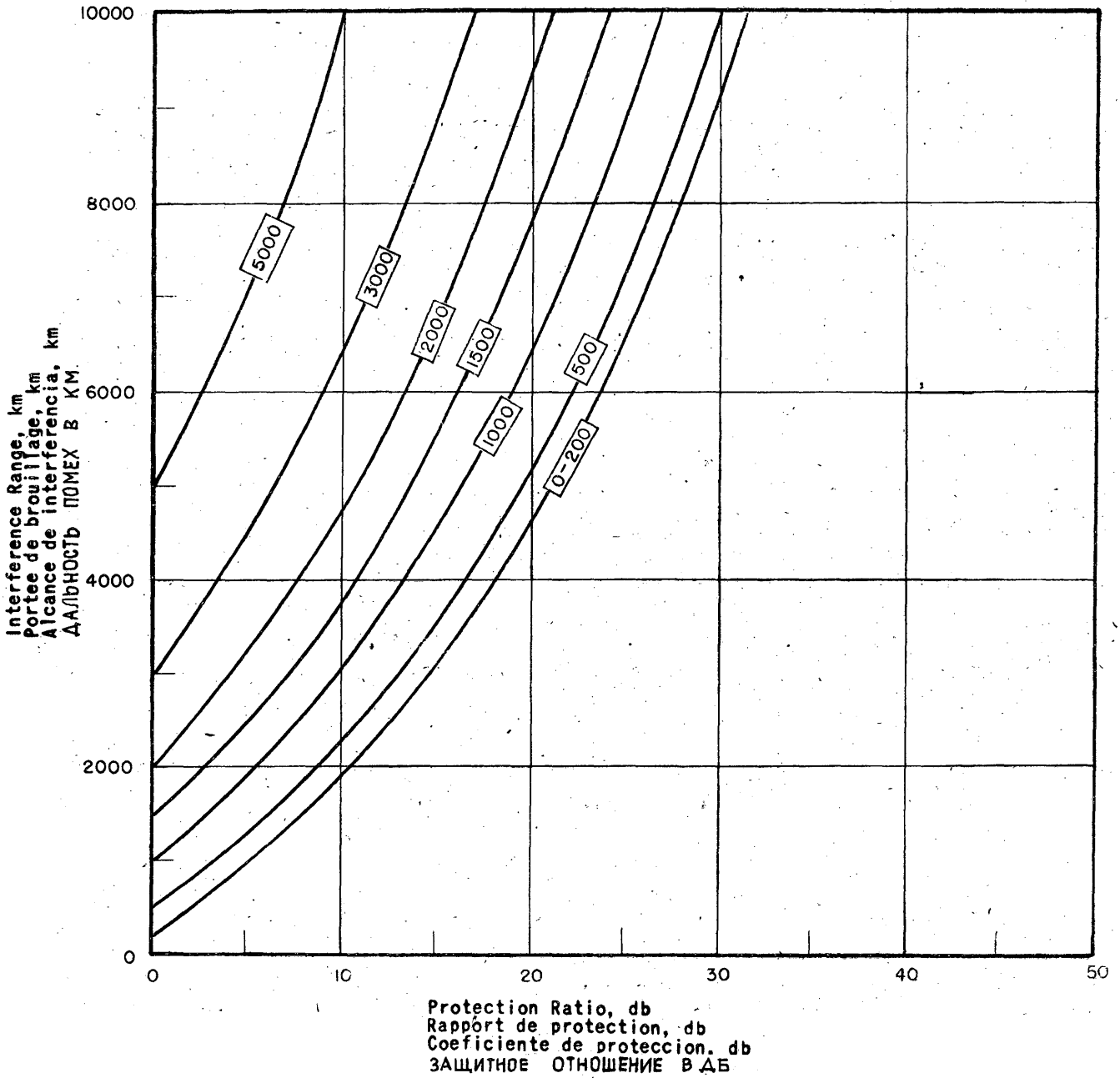
25 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located at right angles to the direction of the subsolar point.

Fig. 94. Alcance de interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

25 Mc/s. Estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en ángulos rectos respecto a la dirección del punto subsolar.

Рис.94. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают полезную дальность действия связи в километрах.

25 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены под прямыми углами к направлению на подсолнечную точку.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion. db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 94 Рис.94

Fig. 95. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

25 Mc/s. Station réceptrice à 60° du point où le soleil est au zenith. Stations émettrices situées dans la direction parallèle à la ligne de démarcation entre le jour et la nuit.

Fig. 95. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

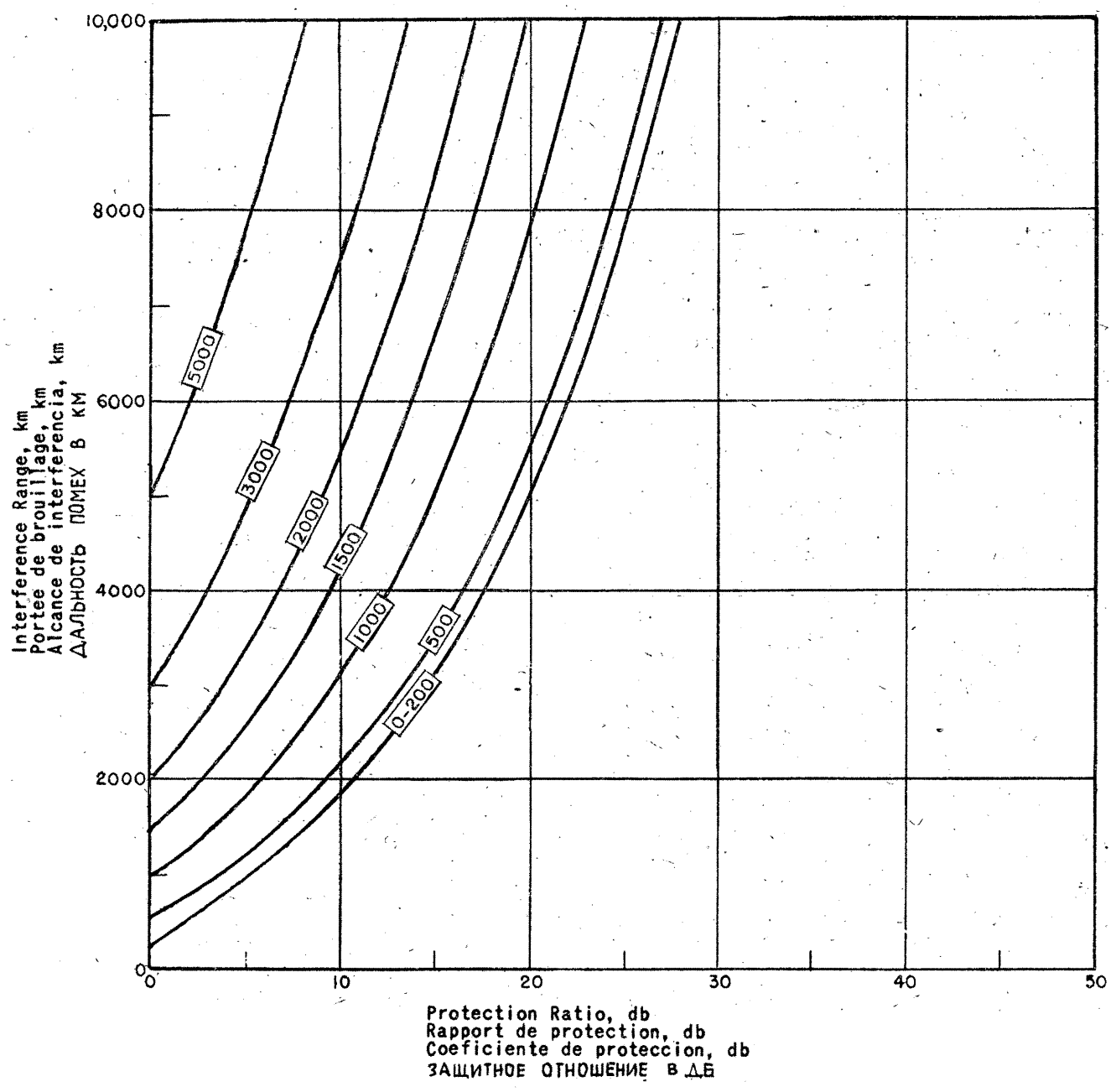
25 Mc/s. Receiving station 60° from the subsolar point. Transmitting stations located in the direction of the day-night line.

Fig. 95. Alcance de la interferencia como función de la distancia de operación y el coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

25 Mc/s. La estación receptora a 60° del punto subsolar. Las estaciones transmisoras emplazadas en la dirección de la línea día-noche.

Рис. 95. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

25 мгц. Приемная станция отстоит на 60° от подсолнечной точки. Передающие станции расположены в направлении линии день-ночь.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 95 Рис. 95

Fig. 96. Portées de brouillage en fonction de la portée utile et du rapport de protection, pour le minimum de l'activité solaire. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

25 Mc/s. Station réceptrice sur la ligne de démarcation entre le jour et la nuit. Stations émettrices situées dans la direction du point où le soleil est au zenith.

Fig. 96. Interference range as a function of service range and protection ratio at sunspot minimum. Numbers on curves give service range in kilometers.

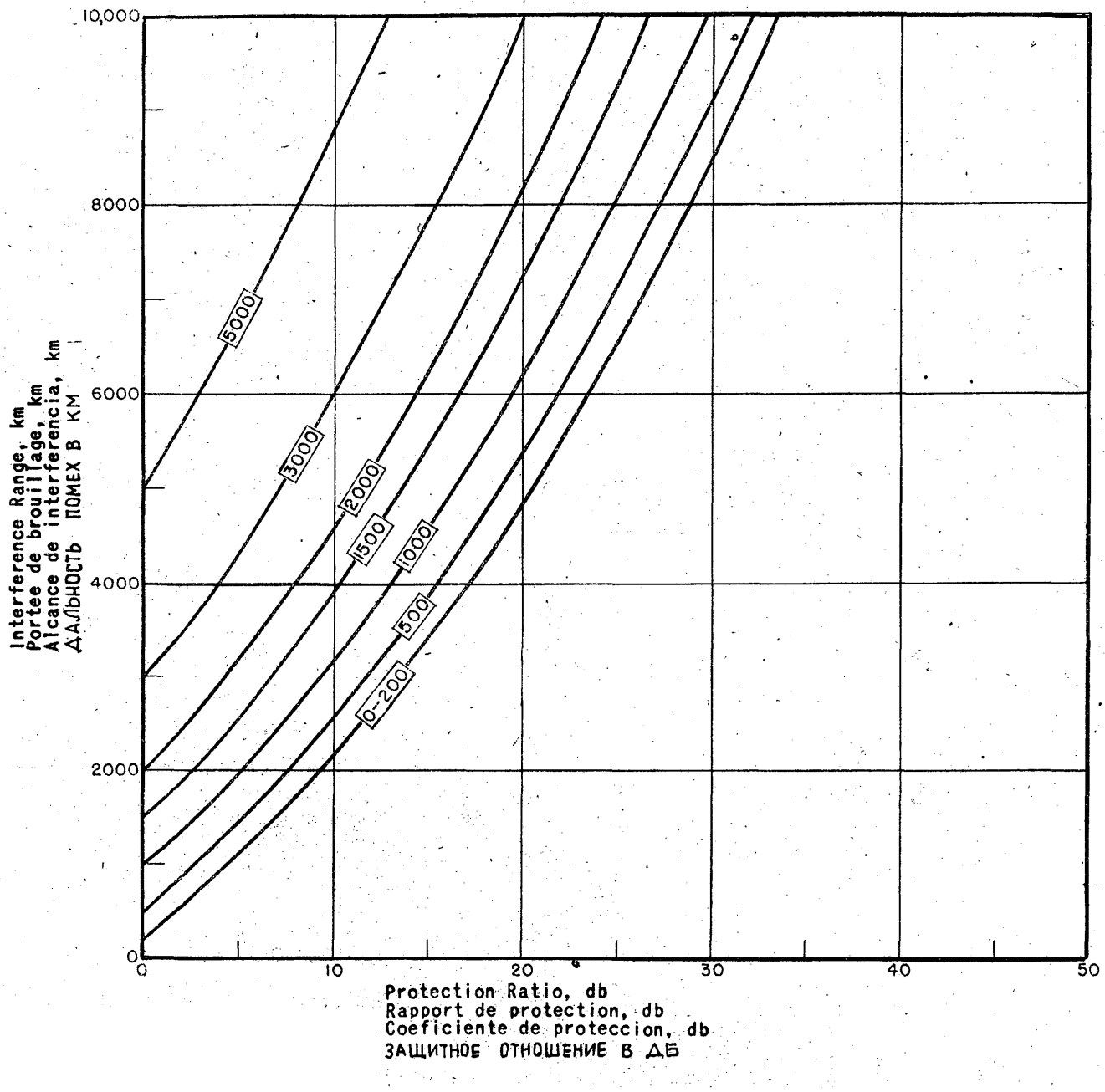
25 Mc/s. Receiving station at the day-night line. Transmitting stations located in the direction of the subsolar point.

Fig. 96. Alcance de la interferencia como función de la distancia de operación y coeficiente de protección en el mínimo de actividad solar. Los números de las curvas indican la distancia de operación en kilómetros.

25 Mc/s. La estación receptora en la línea día-noche. Las estaciones transmisoras emplazadas en la dirección del punto subsolar.

Рис. 96. Дальность помех в зависимости от полезной дальности действия и уровня защиты в период минимума солнечных пятен. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

25 мгц. Приемная станция ни линии день-ночь. Передающая станция расположена в направлении подсолнечной точки.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Interference Range, km
Portee de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

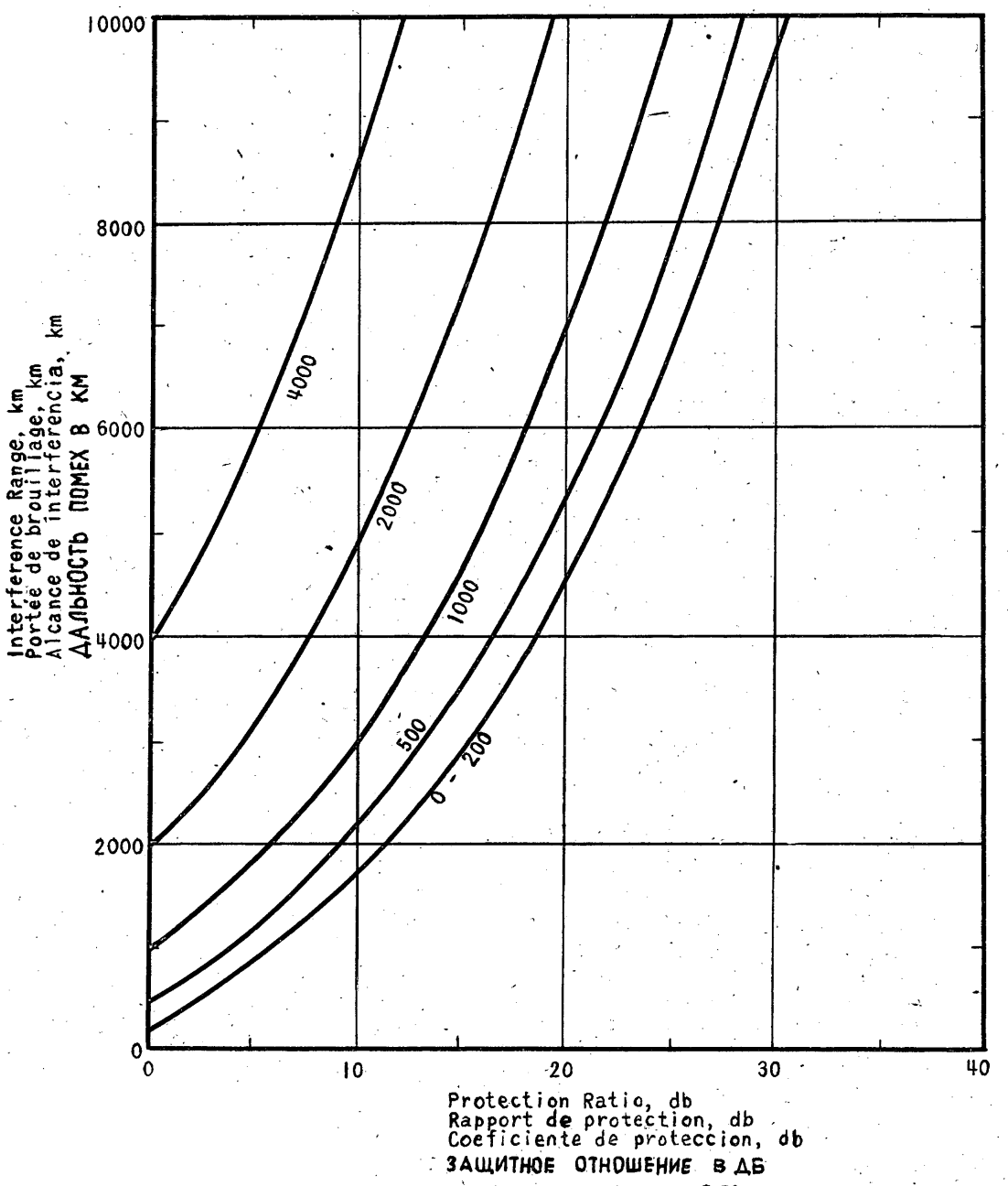
Fig. 96 Рис. 96

Fig. 97. Portées de brouillage en fonction de la portée utile et du rapport de protection, conditions de nuit (sans absorption), pour toutes les fréquences supérieures à 3 Mc/s. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

Fig. 97. Interference range as a function of service range and protection ratio, night conditions (no absorption), all frequencies 3 Mc/s and greater. Numbers on curves give service range in kilometers.

Fig. 97. Alcance de interferencia como función de la distancia de operación y del coeficiente de protección, condiciones nocturnas (absorción nula), todas las frecuencias 3 Mc/s y mayores. Los números de las curvas indican la distancia de operación en kilómetros.

Рис. 97. Дальность помех в зависимости от полезной дальности действия и уровня защиты, в ночных условиях (без поглощения), на всех частотах от 3 мгц и выше. Цифры на кривых обозначают рабочую дальность действия связи в километрах.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Interference Range, km
Portée de brouillage, km
Alcance de interferencia, km
ДАЛЬНОСТЬ ПОМЕХ В КМ
Protection Ratio, db
Rapport de protection, db
Coeficiente de proteccion, db
ЗАЩИТНОЕ ОТНОШЕНИЕ В ДБ

Fig. 97 Рис. 97

Fig. 98. Rapport des intensités des champs du signal utile et du brouilleur en fonction de l'espacement entre fréquences, pour la radiotéléphonie à double bande latérale; fréquence de modulation maximum : 3 kc/s, rapports de protection de 25 db (courbe A) et 30 db (courbe B).

Fig. 98. Field intensity ratio of desired to undesired signals as a function of frequency separation for double-sideband radiotelephone, 3 kc/s maximum modulation frequency, corresponding to protection ratios of 25 decibels (curve A), and 30 decibels (curve B).

Fig. 98. Relación de intensidad de campo de las señales deseadas a indeseadas como función de la separación de frecuencias para radiotelefonía de banda lateral doble, con una frecuencia de modulación máxima de 3 kc/s, coeficientes de protección de 25 decibeles (curva A), y 30 decibeles (curva B).

Рис. 98. Отношение напряженностей поля полезного и мешающего сигналов в зависимости от разделения частот, при двухполосной радиотелефонии, с максимальной частотой модуляции в 3 кгц, соответствующее уровням защиты в 25 дб (кривая А) и в 30 дб (кривая В)

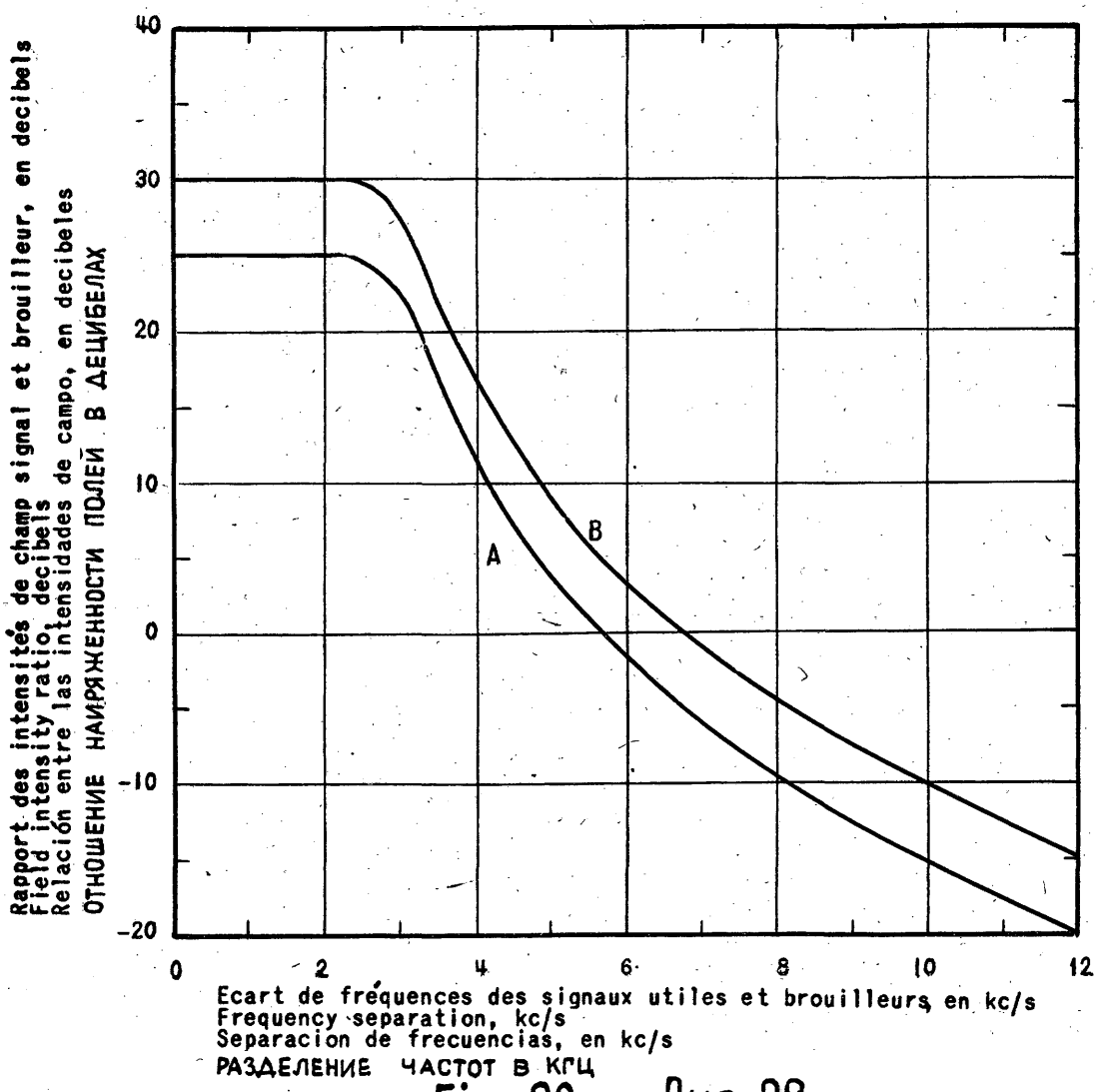
Rapport des intensités de champ signal et brouilleur, en decibels
Field intensity ratio, decibels
Relación entre las intensidades de campo, en decibeles
ОТНОШЕНИЕ НАПРЯЖЕННОСТИ ПОЛЕЙ В ДЕЦИБЕЛАХ
40
30
20
10
0
-10
-20
A
B
0
2
4
6
8
10
12
Ecart de fréquences des signaux utiles et brouilleurs, en kc/s
Frequency separation, kc/s
Separacion de frecuencias, en kc/s
РАЗДЕЛЕНИЕ ЧАСТОТ В КГЦ

Fig. 98 Рис. 98

Fig. 99. Portées de brouillage en fonction de la portée utile et de l'espacement entre fréquences, pour la radiotéléphonie à double bande latérale; fréquence de modulation maximum 3 kc/s, conditions de nuit (sans absorption), pour les fréquences supérieures à 3 Mc/s. Rapport de protection 25 db lorsque les puissances rayonnées sont égales. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

Fig. 99. Interference range as a function of service range and frequency separation, double-sideband radiotelephone, 3 kc/s maximum modulation frequency, night conditions (no absorption), all frequencies 3 Mc/s and greater. Protection ratio 25 decibels for equal radiated powers. Numbers on curves give service range in kilometers.

Fig. 99. Alcance de interferencia como función de la distancia de operación y la separación de frecuencias; radiotelefonía de banda lateral doble, con una frecuencia de modulación máxima de 3 Kc/s, condiciones nocturnas (absorción nula), para las frecuencias de 3 Mc/s y mayores. Coeficiente de protección de 25 decibeles para potencias irradiadas iguales. Los números en las curvas indican la distancia de operación en kilómetros.

Рис. 99. Дальность помех в зависимости от рабочей дальности действия связи и разделения частот при двухполосной радиотелефонии с максимальной частотой модуляции в 3 кгц, в ночных условиях (без поглощения для всех частот в 3 мгц и выше). Уровень защиты в 25 дб при одинаковой излучаемой мощности. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

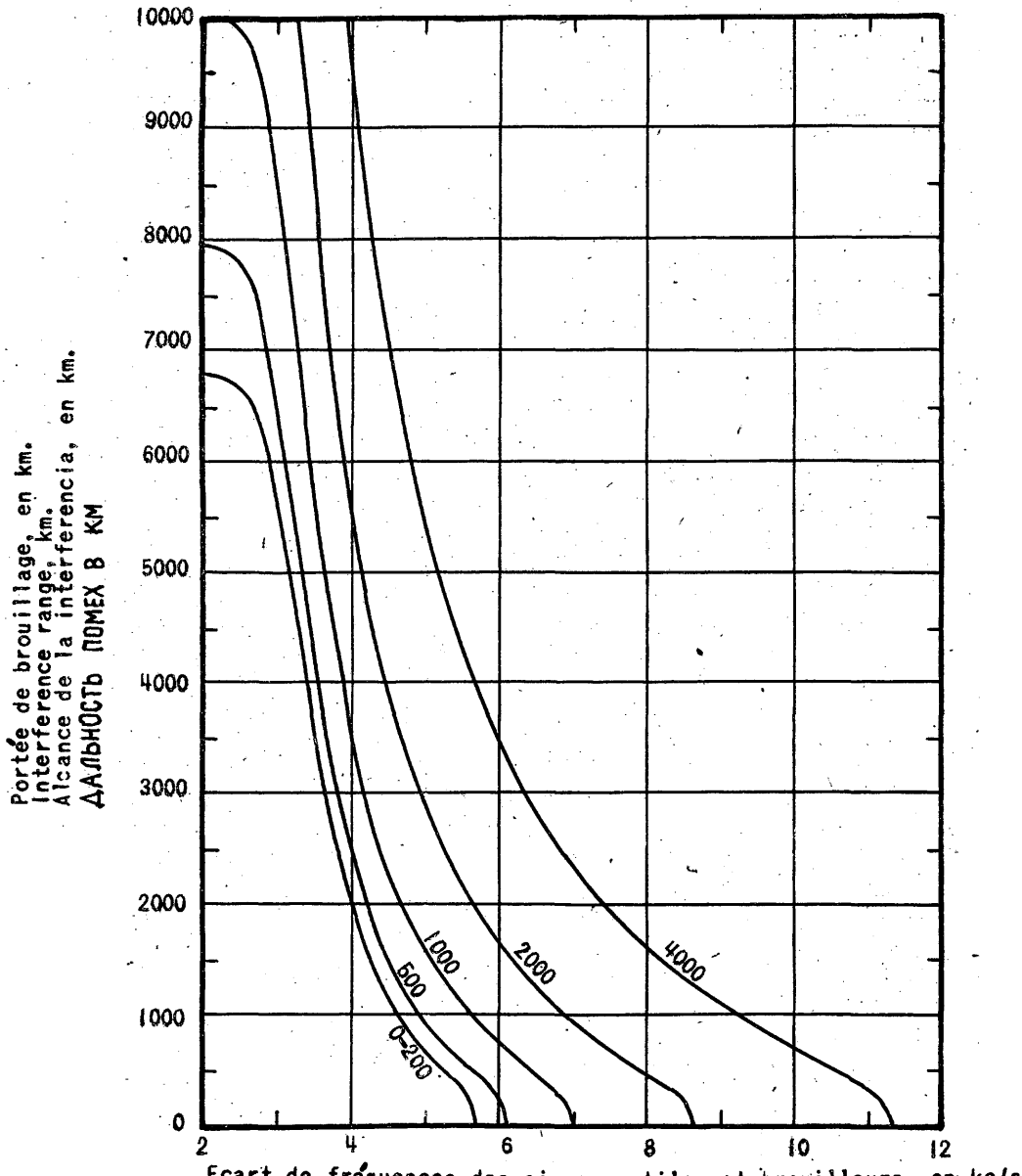
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2
4
6
8
10
12
1000
500
0-200
2000
4000
Portée de brouillage, en km.
Interference range, km.
Alcance de la interferencia, en km.
ДАЛЬНОСТЬ ПОМЕХ В КМ
Ecart de fréquences des signaux utiles et brouilleurs, en kc/s
Frequency separation, kc/s
Separacion de frecuencias, en kc/s
РАЗДЕЛЕНИЕ ЧАСТОТ В КГЦ

Fig. 99 Рис. 99

Fig. 100. Portées de brouillage en fonction de la portée utile et de l'espacement entre fréquences pour la radiotéléphonie à double bande latérale; fréquence de modulation maximum 3 kc/s, conditions de nuit (sans absorption), pour les fréquences supérieures à 3 Mc/s. Rapport de protection 30 db lorsque les puissances rayonnées sont égales. Les chiffres sur les courbes indiquent la portée utile en kilomètres.

Fig. 100. Interference range as a function of service range and frequency separation, double-sideband radiotelephone, 3 kc/s maximum modulation frequency, night conditions (no absorption), all frequencies 3 Mc/s and greater. Protection ratio 30 decibels for equal radiated powers. Numbers on curves give service range in kilometers.

Fig. 100. Alcance de interferencia como función de la distancia de operación y la separación de frecuencias; radiotelefonía de banda lateral doble, con una frecuencia de modulación máxima de 3 Kc/s, condiciones nocturnas (absorción nula), para las frecuencias de 3 Mc/s y mayores. Coeficiente de protección de 30 decibeles para potencias irradiadas iguales. Los números en las curvas indican la distancia de operación en kilómetros.

Рис.100. Дальность помех в зависимости от рабочей дальности действия связи и разделения частот, при двухполосной радиотелефонии с максимальной частотой модуляции в 3 кгц, в ночных условиях (без поглощения) для всех частот в 3 мгц и выше. Уровень защиты в 30 дб/ при одинаковой излучаемой мощности. Цифры на кривых обозначают рабочую дальность действия связи в километрах.

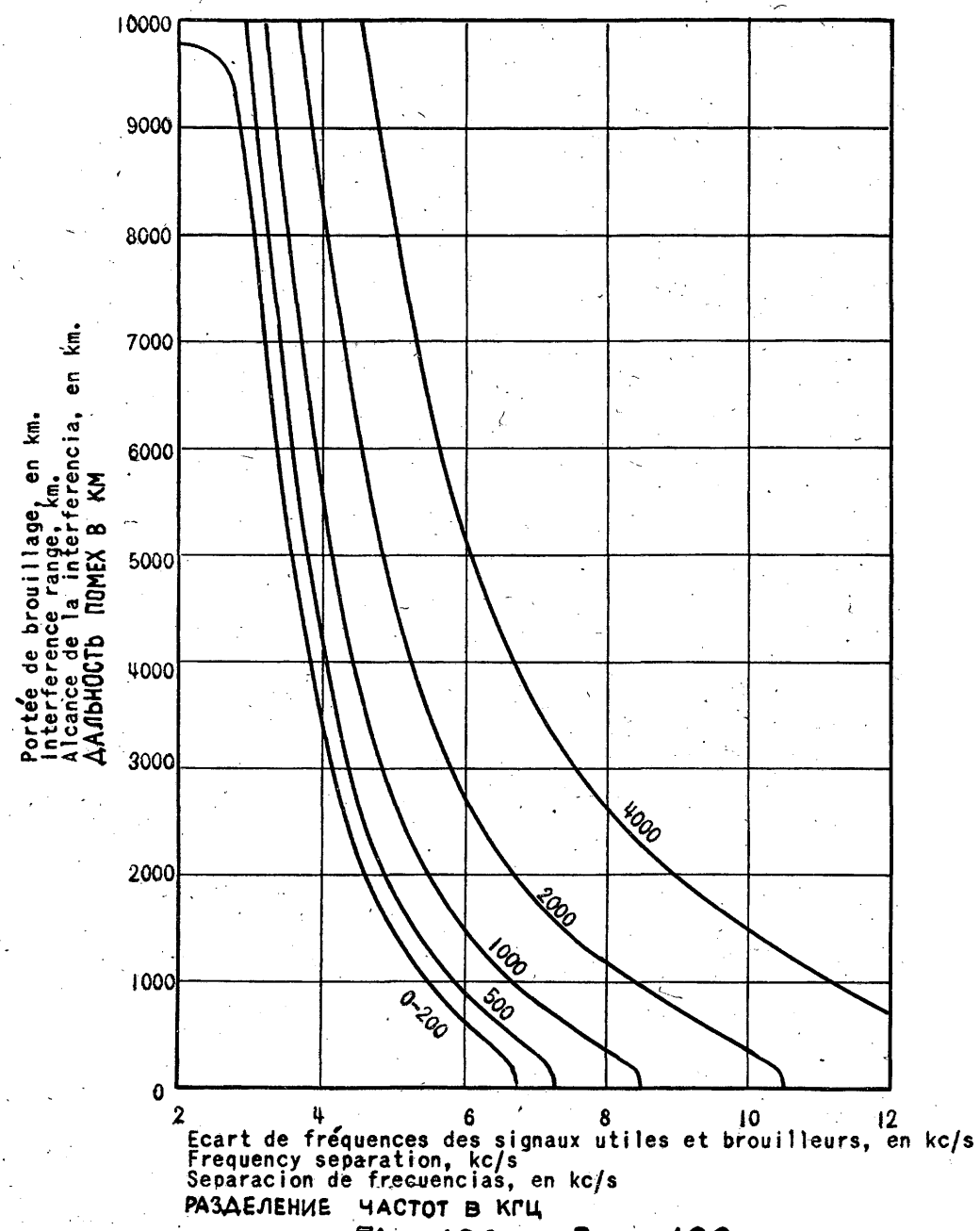

Fig. 100 Рис. 100

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