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RADIO PROPAGATION UNIT

TECHNICAL REPORT No. 5

MINIMUM REQUIRED FIELD INTENSITIES FOR INTELLIGIBLE RECEPTION OF RADIOTELEPHONY IN PRESENCE OF ATMOSPHERICS OR RECEIVING SET NOISE

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This report has been prepared under the direction of the Chief Signal Officer by the Radio Propagation Unit, Baltimore Signal Depot, Baltimore 20, Maryland

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MINIMUM REQUIRED FIELD INTENSITIES FOR INTELLIGIBLE RECEPTION OF RADIOTELEPHONY IN PRESENCE OF ATMOSPHERICS OR RECEIVING SET NOISE

Prepared By

RADIO PROPAGATION UNIT
BALTIMORE SIGNAL DEPOT
BALTIMORE 20, MARYLAND

REVISED

JUNE 1949

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Minimum Required Field Intensities for Intelligible Reception of Radiotelephony in Presence of Atmospheric or Receiving Noise

I Purpose

a. This report shows the minimum required strength for intelligible reception of radiotelephony. Curves are given for both atmospheric and receiver noise.

b. In order for the communication to be intelligible, the signal at the receiver must override the noise present in the receiving system. The total noise in a receiving system is tube noise, thermal noise produced across resistances, thermal noise produced in the antenna circuit, and external noise that is induced into the antenna. In the case of fluctuation of noises, the annoyance effects can be expressed in signal-to-noise ratios. The signal strength at the receiver must be such that the signal-to-noise ratio at the receiver output will be sufficient for intelligible reception. The disturbing effects of noise depend upon the intensity of noise at the receiver, the receiving antenna, the receiver characteristics, and the allowable output signal-to-noise ratio.

c. The general noise conditions at the receiver can be accounted for by the curves of this report. Man-made noises, such as produced by electrical apparatus, are not accounted for. These noises depend upon special circumstances and usually can be greatly minimized or eliminated. The atmospheric noise curves correspond to average noise conditions. The effects of local thunderstorms are not included. Precipitation static which arises from the interaction of the receiving antenna and snow, rain, or dust, is not accounted for although it may at times be the largest external noise source. Figure 58 shows the minimum required incident field intensity for the intelligible reception of double sideband radiotelephony in the presence of cosmic noise (noise from intercellar space).

II Atmospheric Noise

a. Measurements have been made of atmospheric noise at a number of locations throughout the world at different periods of time. Although the measurements cannot be called complete, they indicate the difference between noise at various locations, various frequencies, and different hours of the day. Variations in noise intensities from day-to-day at a particular hour fall relatively close to the seasonal median value. The seasonal variations differ with receiver locations and variations with the 11 year sunspot cycle are not very well defined. Even though the origin of atmospheric noise is not completely understood, it is generally known that the majority of atmospheric noise with the exception of the precipitation static is due to atmospheric storms. The noise level at a particular location is due to the contributions of both local and distant sources. It has been shown that on an average during a local thunderstorm, the noise level is about 10 decibels higher than the average noise for the same period. From the above, it can be seen that the atmospheric noise level is directly related with weather conditions. The position of the equatorial weather front greatly effects the atmospheric noise

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at all locations. This front varies in position from day-to-day in its general location, moving seasonally north with the sun. The degree of activity varies from time to time and from place to place, being much greater over land than over sea. Thunderstorms are present for about 50% of the day at locations in these equatorial belts. It is estimated that there are about 2,000 thunderstorms in progress at each instant throughout the world. The thunderstorm activity in these equatorial weather belts, notably the East Indies, Equatorial Africa, Equatorial South America, and Central America, appear to be the principal source for long distance atmospheric noise. Storm activity is located over tropical land masses during the local summer season. Thunderstorms are more active over land and usually occur at hours from 1200 to 1700 local time. Thunderstorm activity over sea generally occurs at night and can last for more than a day.

b. Atmospheric noise from local sources shows discrete crashes similar to impulse noise while long distance atmospheric noise consists of rapid and irregular fluctuations with a frequency of 10 to 20 kilocycles per second and a damped wave train of oscillations. The output response in a receiver is approximately proportional to the square root of the receiver band width and, thus, approximates fluctuation noise. The amplitude of lightning disturbances varies approximately inversely with the frequency squared and is propagated in all directions both for ground and sky-waves. Noise propagation follows normal propagation laws and when conditions are suitable, multiple impulses are received with an increase in the noise field at the receiving location. The measurements show that the general noise field is greater at night than during the day for frequencies between 1 and 5 megacycles per second due to the large daytime absorption of these frequencies. At frequencies between 10 and 15 megacycles per second, there is little difference between day and night values. During the day the absorption is present, but the ionosphere supports these frequencies more effectively. The measurements show that, in general, the noise level is greater in the summertime, the difference varying between 5 and 20 decibels depending upon the frequency and location.

c. The atmospheric noise curves are drawn for average conditions for various noise grades (geographical locations with the same noise conditions). The relationship between noise at various locations is determined from measurements and estimates of weather conditions from meteorological data. The curves do not account for extreme noise conditions, such as a thunderstorm, within a few miles from the receiving location. Figures 1 through 4 are world noise contour maps for each of four three-month periods. The noise contours are numbered from 1 through 5 according to the relative noise level, with number 5 indicating the highest noise level, and number 1 the lowest. The principal centers of thunderstorm activity occur in areas marked 4 or more. In areas marked 1 and 2, the noise is mainly due to that propagated from the principal noise centers since local thunderstorms are infrequent.

d. Figures 5 through 23 are plots of the required incident field intensity for various noise grades against frequencies at six different hours of the day; 00, 04, 08, 12, 16, and 20 hours local time. Due to the effect of the sun on noise propagation, separate noise curves have been drawn for summer, winter, and equinox for the noise grades which occur at high latitude. Equinox curves are used throughout the year at latitudes less than 30 degrees.

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e. The atmospheric noise curves are drawn for the hourly median values required for intelligible reception for 90% of the days of low grade, double sideband radiotelephony for a total receiver band width of 6 kilocycles. The curves were obtained from measured noise voltages which were converted into incident field strengths after increasing them to adjust for the required output signal-to-noise ratio and for day-to-day variations in both sky-wave field intensities and atmospheric noise. The measured voltages correspond to the hourly median of the average atmospheric noise voltages as recorded on the long time constant recorder. The required signal-to-noise ratio was obtained from measurements taken to determine the required carrier-to-average atmospheric noise ratio for 90% intelligibility of sentences per kilocycle band width. Since both average and root mean square fluctuation noise voltages are proportional to the band width, the measurements can be used for any band width provided the noise generated in the receiving set is small compared to the external noise. The ratio used was 13.8 decibels for a 6 kilocycle band width. The hourly median sky-wave field intensity that is exceeded for 90% of the days has been shown to be 6 decibels below the monthly median of the hourly median values. The hourly median noise field intensity is less for 90% of the day than a value 10 decibels greater than the seasonal median of the hourly median noise intensities. Since both signal and noise vary in normal distributions, the signal-to-noise ratio can be stated to vary as the root sum of the squares of the noise and signal variations. The required minimum field intensities in the presence of atmospheric noise were, thus, obtained from measured average noise voltages referred to the receiver input based on a 6 kilocycle band width which were converted to the required hourly median signal voltage across the receiver input for intelligible reception for 90% of the days by adding 13.8 decibels, the required non-fading carrier-to-noise ratio for 90% intelligibility for low grade double sideband radiotelephony and 11.6 decibels, the fading factor to convert the measurements to a 90% of the days basis. This required input signal to the receiver was then converted into the required incident field intensity by using ground plane effective heights of the vertical noise measuring antennas. The following equation indicates how the atmospheric noise curves were obtained:

$$E_r = \frac{K E_c}{H_e \Delta f}$$

where E_r is the required field intensity in microvolts per meter

K is the experimentally obtained carrier-to-average noise ratio for the desired grade of communication per kilocycle band width

E_c is the measured average received noise voltage referred to the antenna terminals

H_e is the antenna effective height in meters

Δf is the effective receiver band width in kilocycles

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f. The atmospheric noise curves cannot be directly used to determine the required incident signal strength unless the receiving antenna effective heights for both the signal and noise are alike. Figures 24 through 56 of this report give discrimination gains for various common receiving antennas based on omnidirectional noise. The subtraction of a discrimination gain from the minimum required incident field intensity in the presence of atmospheric noise gives the required signal strength for the particular receiving antenna used.

III Receiving Set Noise

a. The annoyance value of noise generated in a receiver set is indicated in minimum required incident field intensity curves, Figures 24 through 56. These curves show the incident field intensity at various angles above the ground plane at the receiving antenna that will produce a sufficient signal across the antenna input to override the effects of receiver noise. The day-to-day variations in sky-wave field intensities have been included to convert them to 90% of the days basis. It has been experimentally shown that approximately 2 microvolts are required across the input of average army receivers of 6 kilocycles band width to produce 90% intelligibility of 100% amplitude modulated radiotelephony when set noise alone produces the disturbance. The average receiver input resistance is assumed tuned out. In the whip antenna calculations, a 600 to 100 ohm impedance matching transformer is assumed to be connected between the antenna and the receiver with 2 microvolts being required across the 100 ohm receiver input side. Transmission line and matching impedance losses have been neglected in the curves. If these losses are known, they can be added to the required field intensity curves. The set noise curves have been calculated by an equation based on the reciprocity theorem, as follows:

$$E = \frac{24.6\, f}{\sqrt{R_r}\, F} \; \frac{R_r + R_L + R_a}{R_a} \; S \text{ to produce 2 microvolts across } R_a$$

where R_r is the antenna radiation resistance

R_L is the antenna loss resistance

R_a is the antenna load resistance

F is the theoretical inverse field intensity in millivolts per meter produced by antenna at one mile in desired direction when used as a transmitting antenna, with one kilowatt delivered to antenna, assuming zero for the antenna loss resistance.

where f is the frequency in megacycles per second

E is the required incident field intensity in microvolts per meter

S is a factor which accounts for variations in the incident field intensity with time.

IV Use of the Curves

A. Minimum required field intensity in the presence of atmospheric noise.

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a. First, determine the noise grade at the receiving location from the world noise distribution maps, Figures 1 through 4. Next, read the minimum required field intensity for radio telephone service at the proper frequency and local time from the figure corresponding to the receiving location noise grade and season. For other types of service, raise or lower the field intensity by amounts shown in Radio Propagation Unit Technical Report No. 4. In case the receiving antenna discriminates in favor of signal over noise, modify the required field intensity as shown in Figures 4 through 56.

B. Minimum Field Intensity in Presence of Receiving Set Noise

a. Determine the vertical wave arrival angle from Figure 59 in this report, reading the angle corresponding to the ionosphere layer height and the distance between the transmitting and receiving locations. Next, read the required incident field intensity to overcome the set noise from the set noise curve for the particular receiving antenna and the ground type at the receiving location. For types of service other than radiotelephone modify the set noise curves by amounts in Radio Propagation Unit Technical Report No. 4.

C. Minimum Required Field Intensity as Determined by Both Atmospheric and Set Noise

a. The minimum required field intensity for a particular hour of the day, frequency and receiving antenna type is determined by the higher of the two noise limitations.

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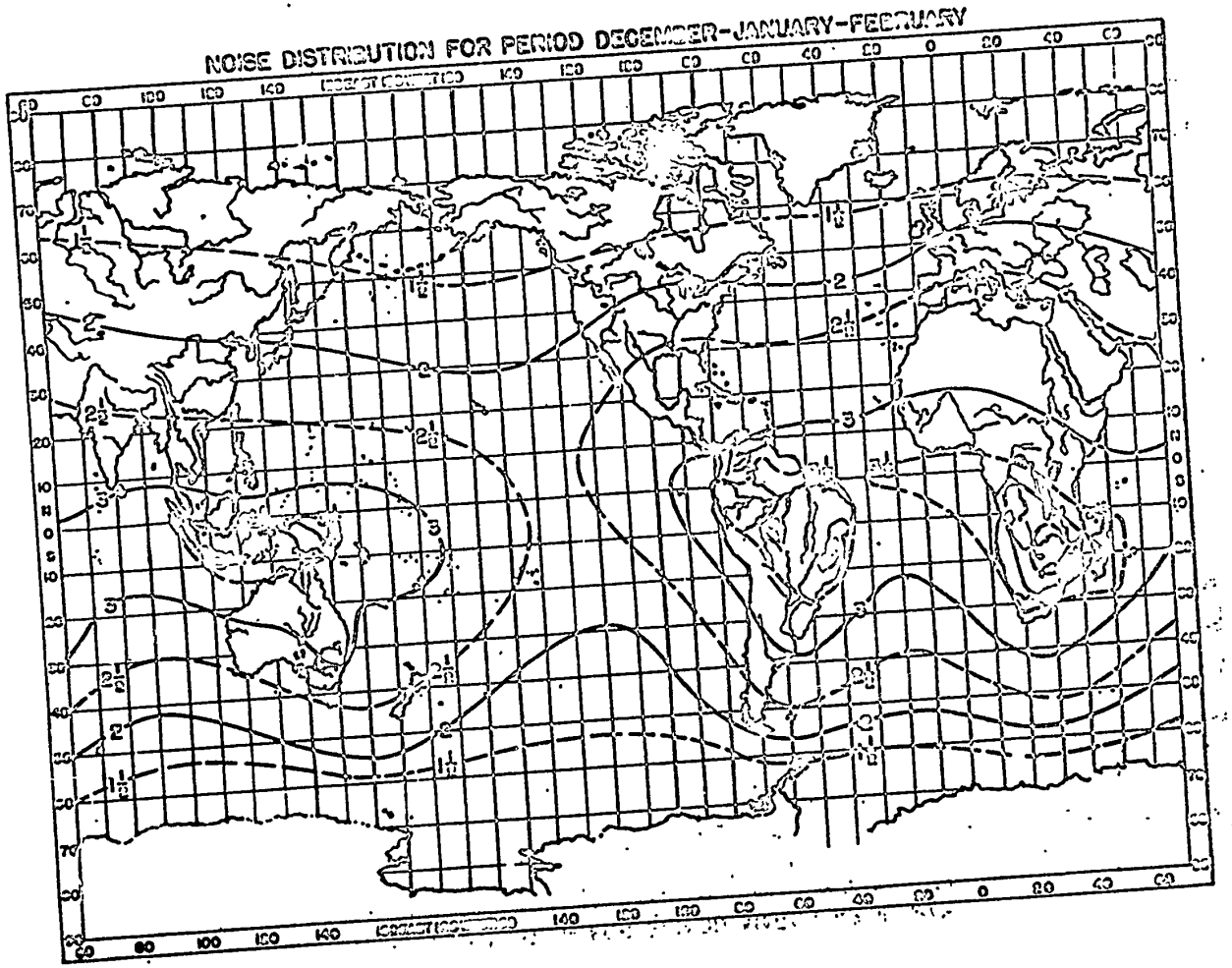

Figure 1

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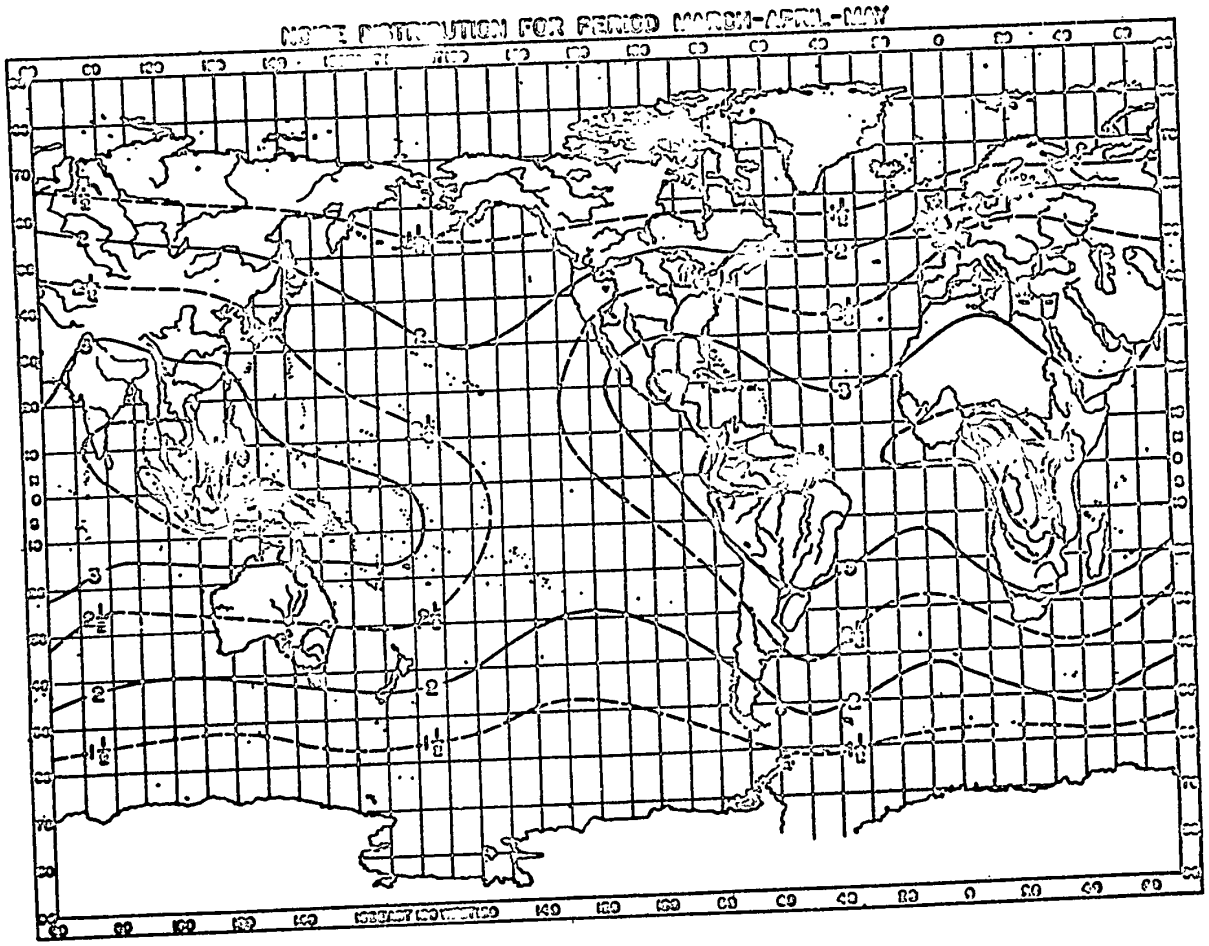

Figure 2

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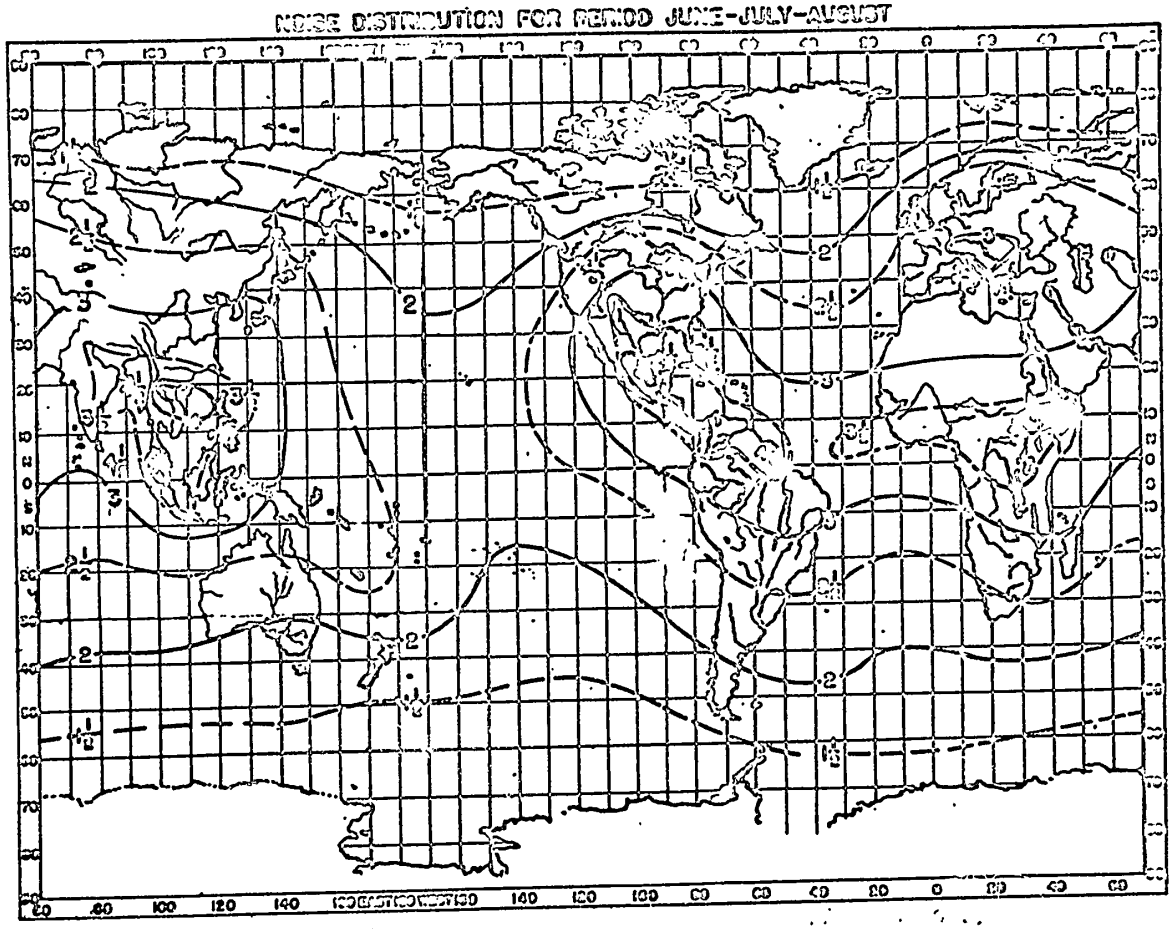

Figure 3

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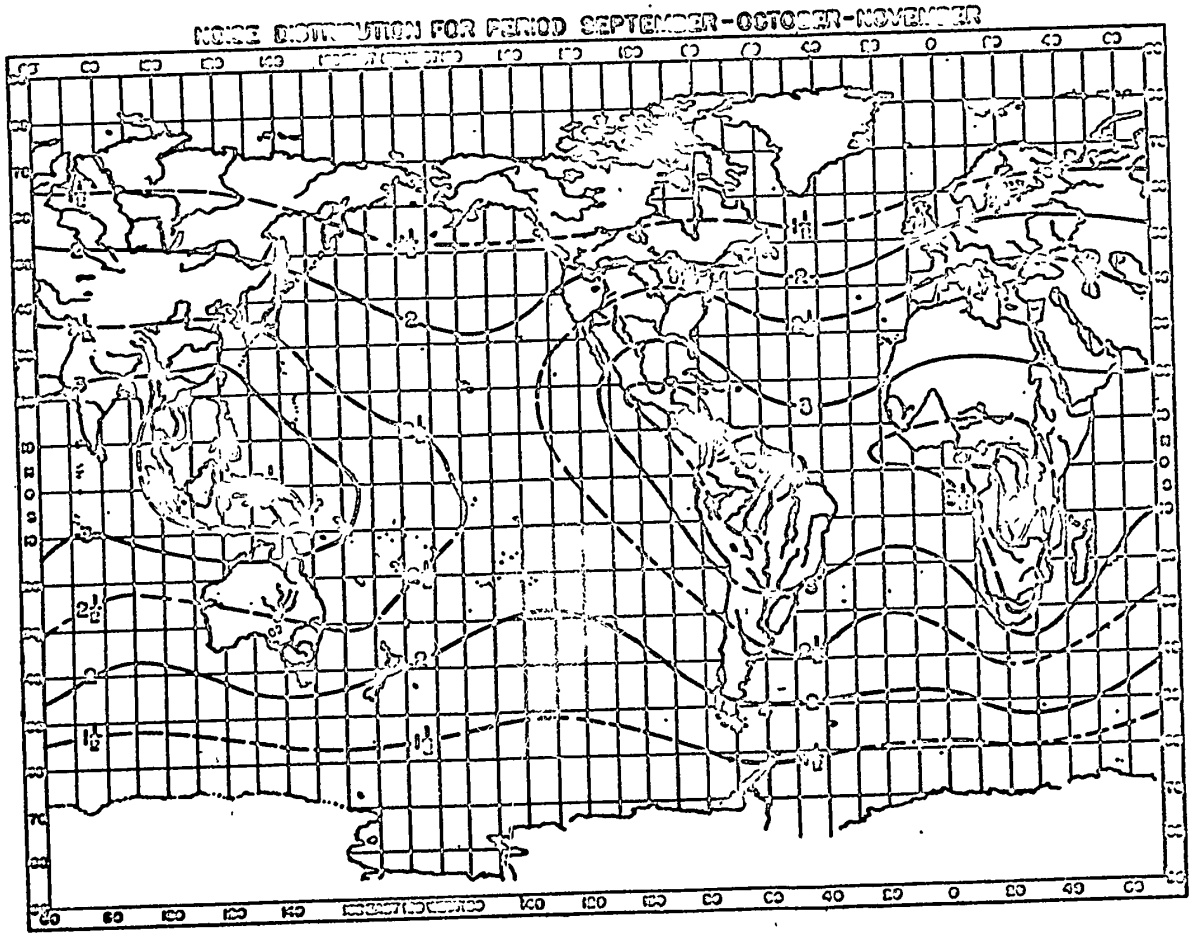

Figure 4

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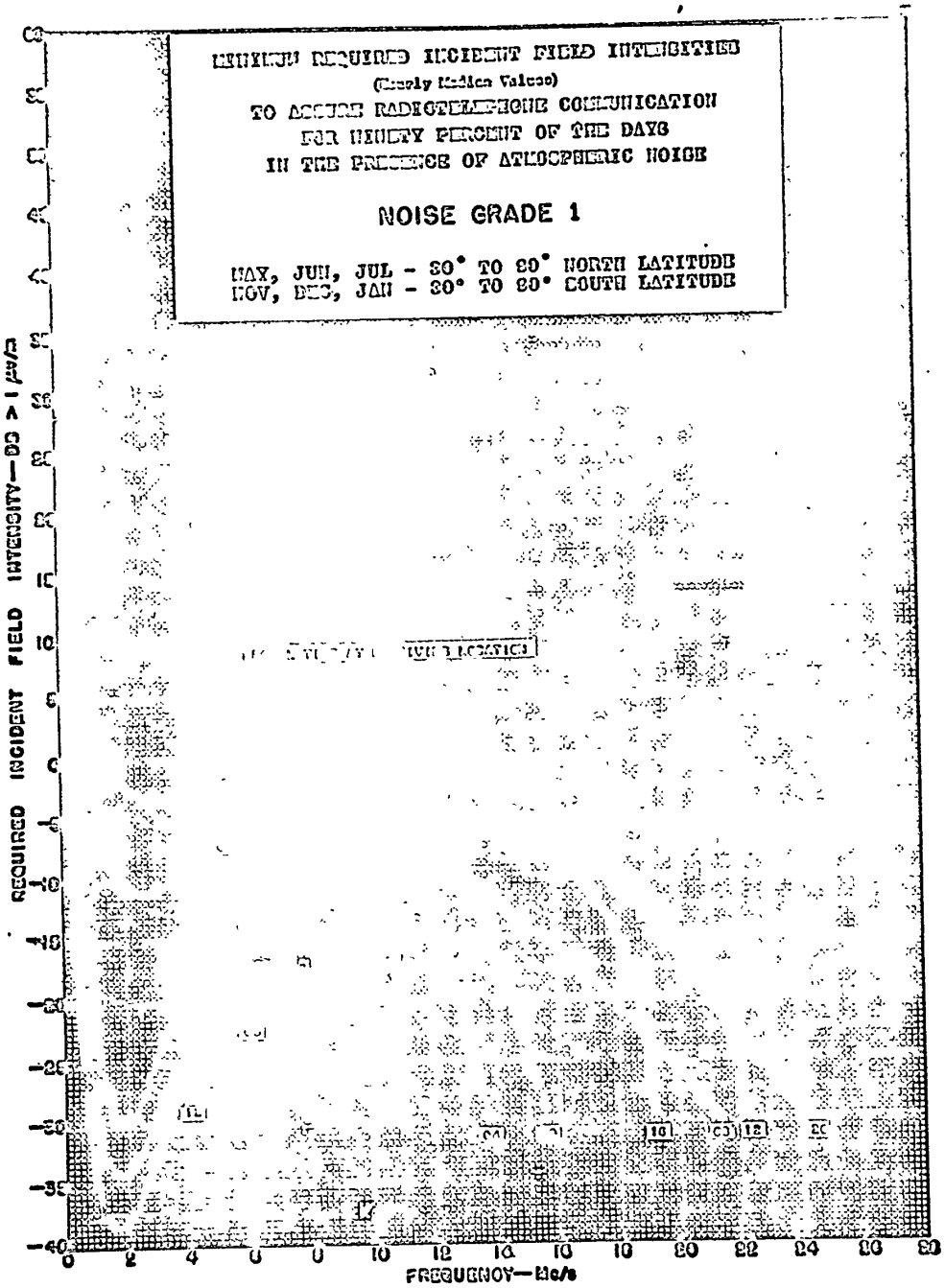

Figure 5

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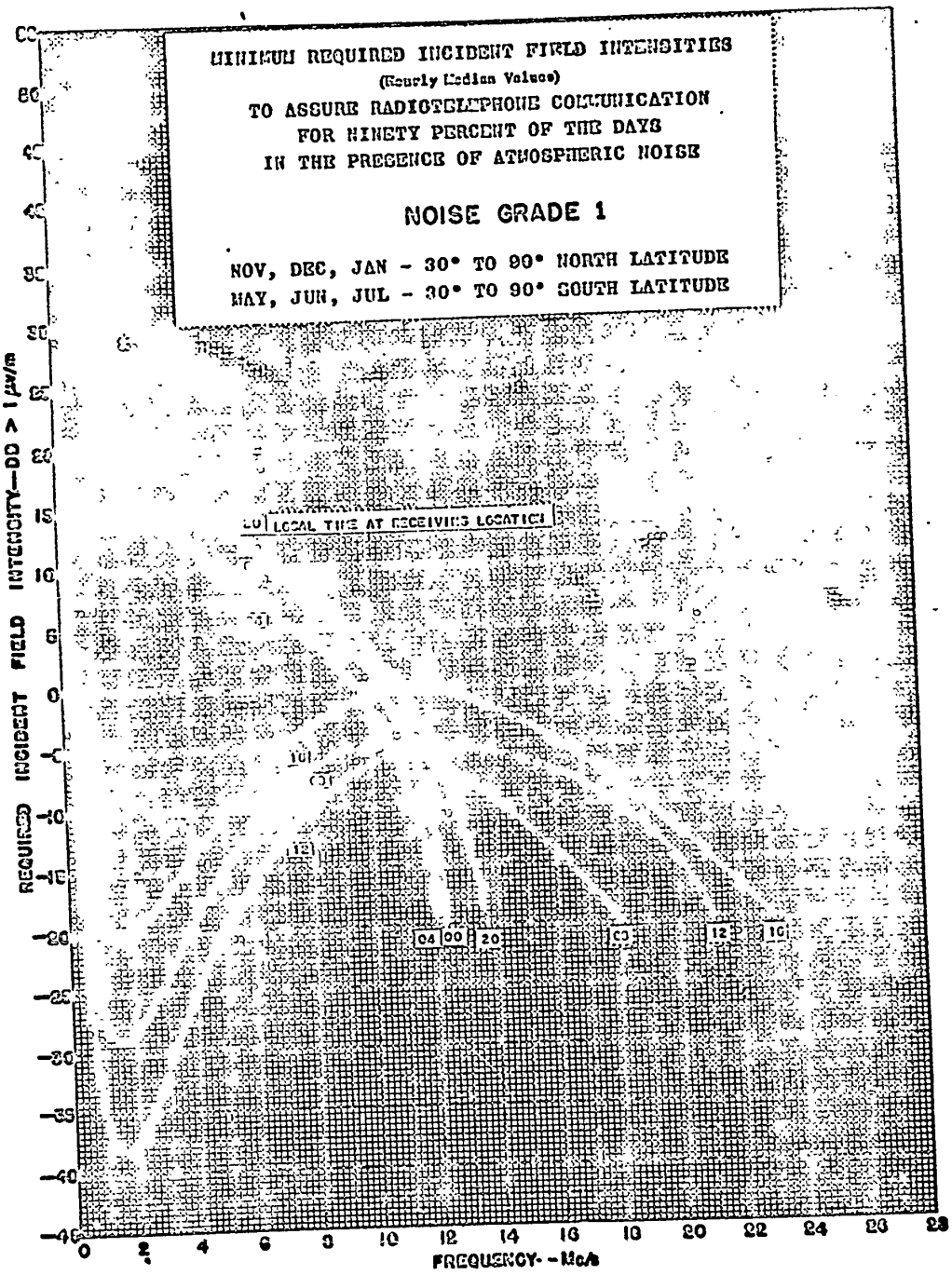

Figure 6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(Hourly Median Values)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF ATMOSPHERIC NOISE

NOISE GRADE 1

ALL MONTHS - 30° NORTH TO 30° SOUTH LATITUDE
AUG, SEP, OCT, FEB, MAR, APR - ALL LOCATIONS

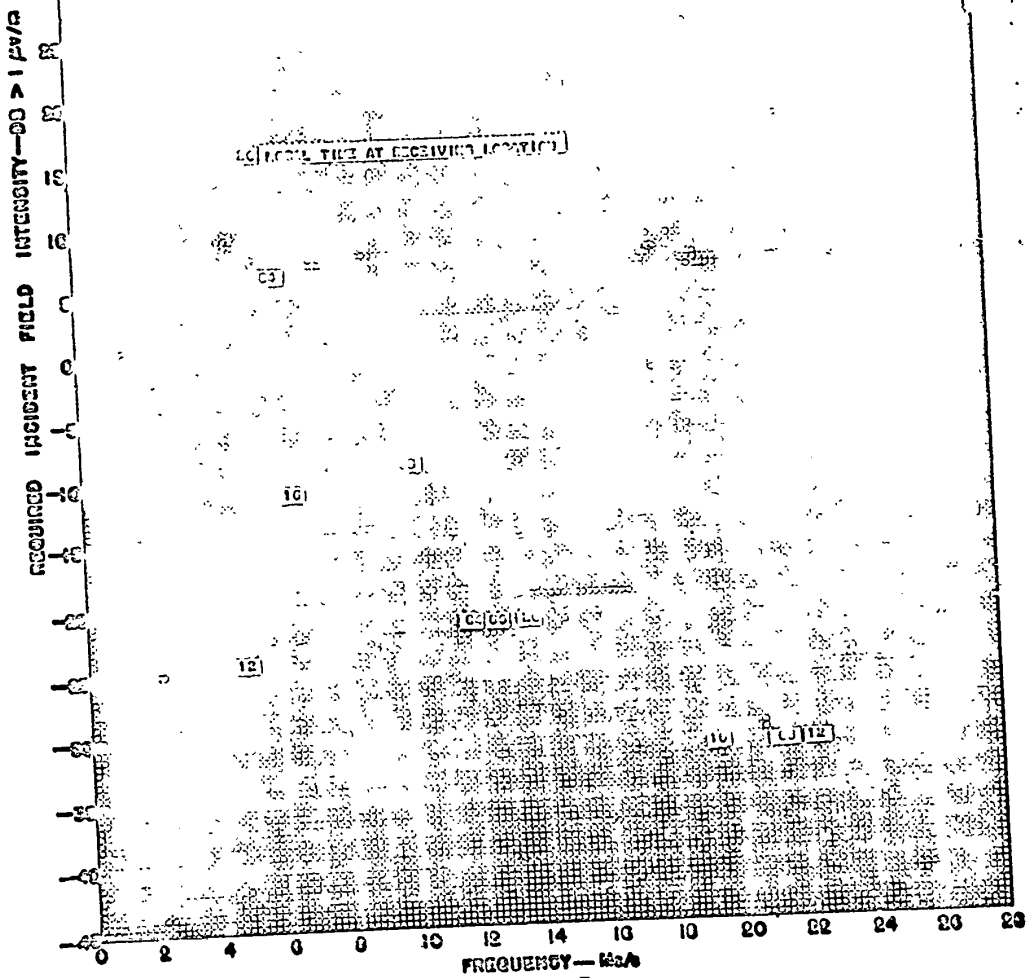

Figure 7

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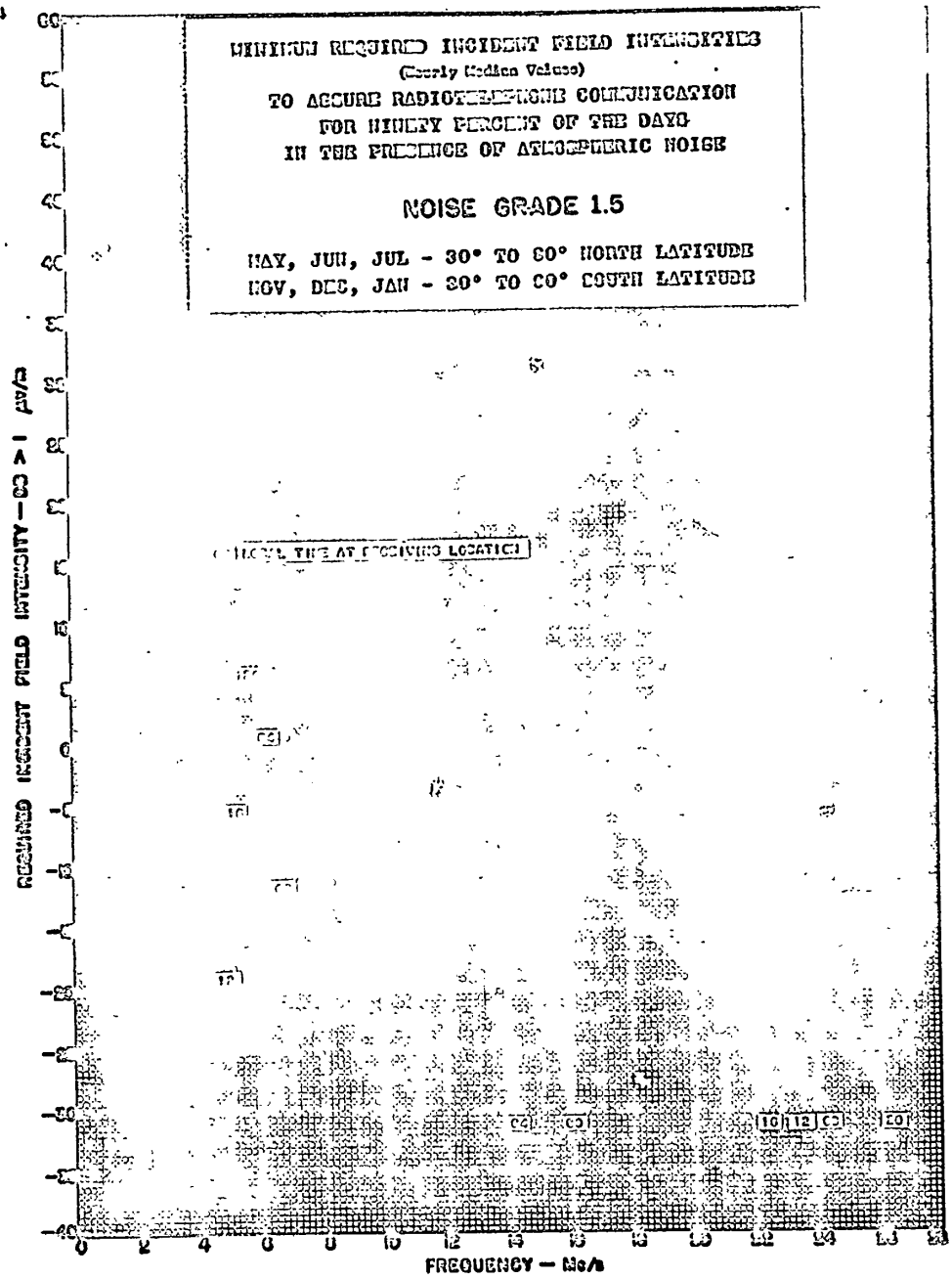
FOUO FINAL

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(Yearly Median Values)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF ATMOSPHERIC NOISE

NOISE GRADE 1.5

MAY, JUN, JUL - 30° TO 60° NORTH LATITUDE
NOV, DEC, JAN - 30° TO 60° SOUTH LATITUDE



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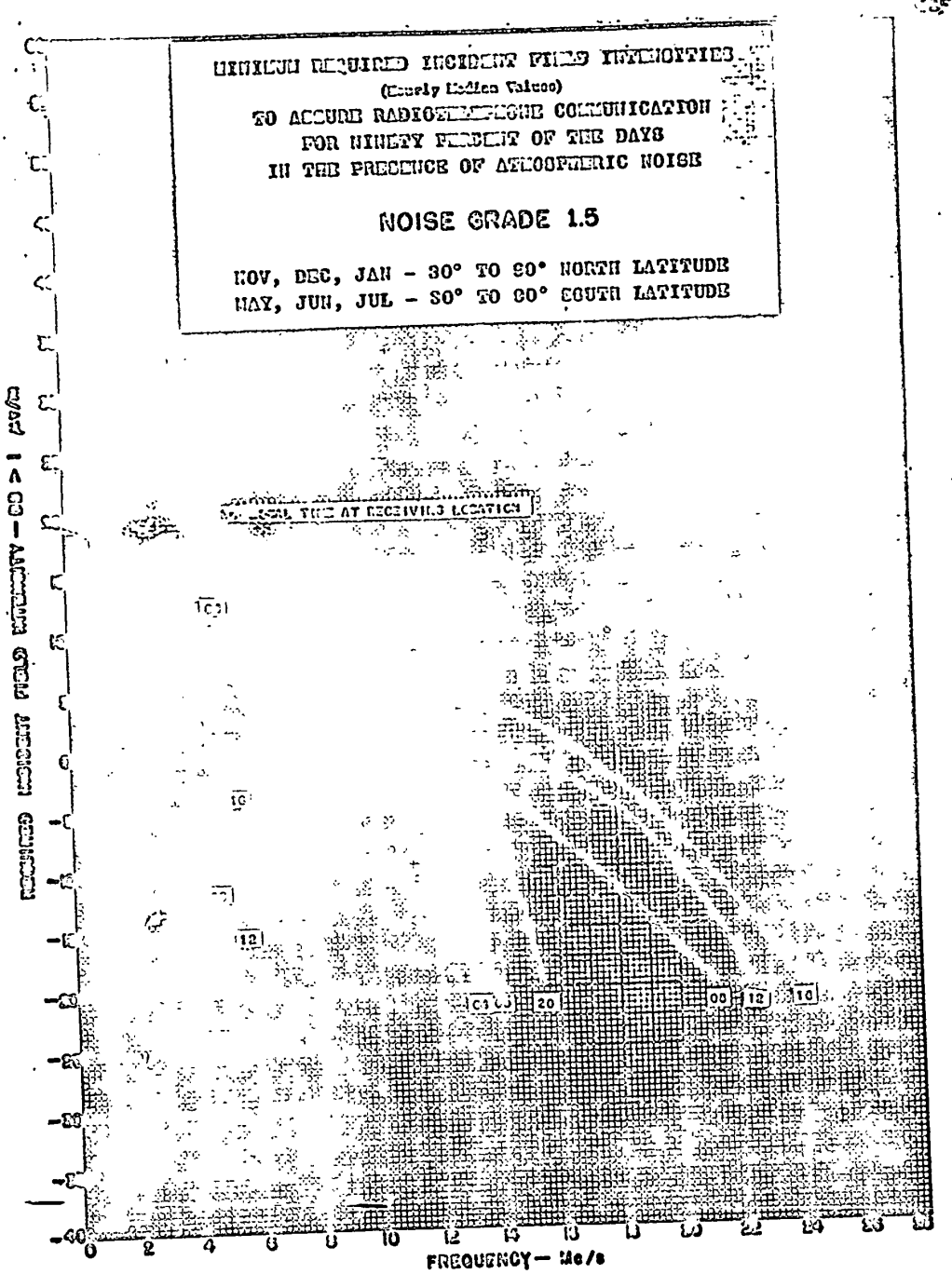

Figure 9

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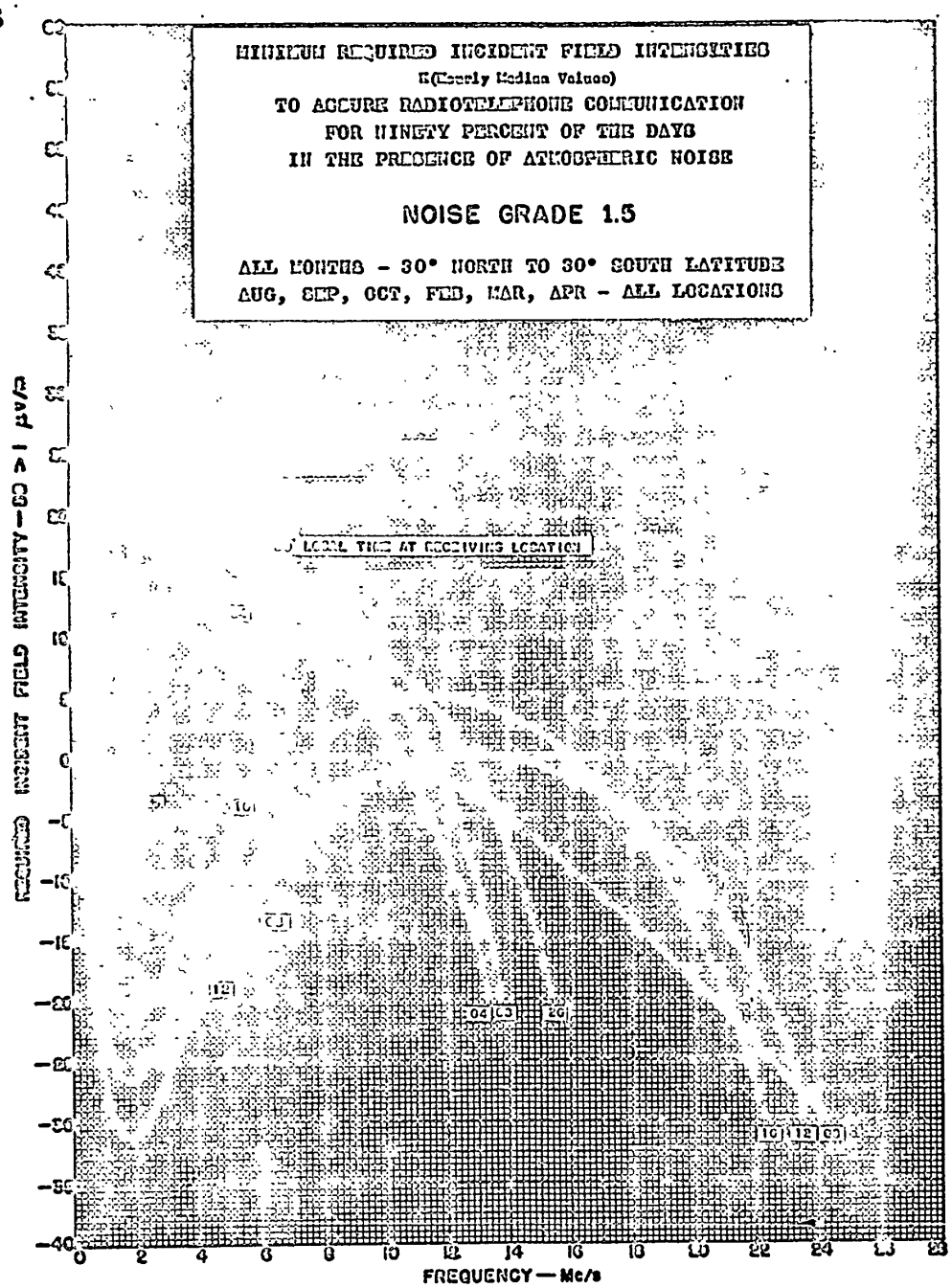

Figure 10

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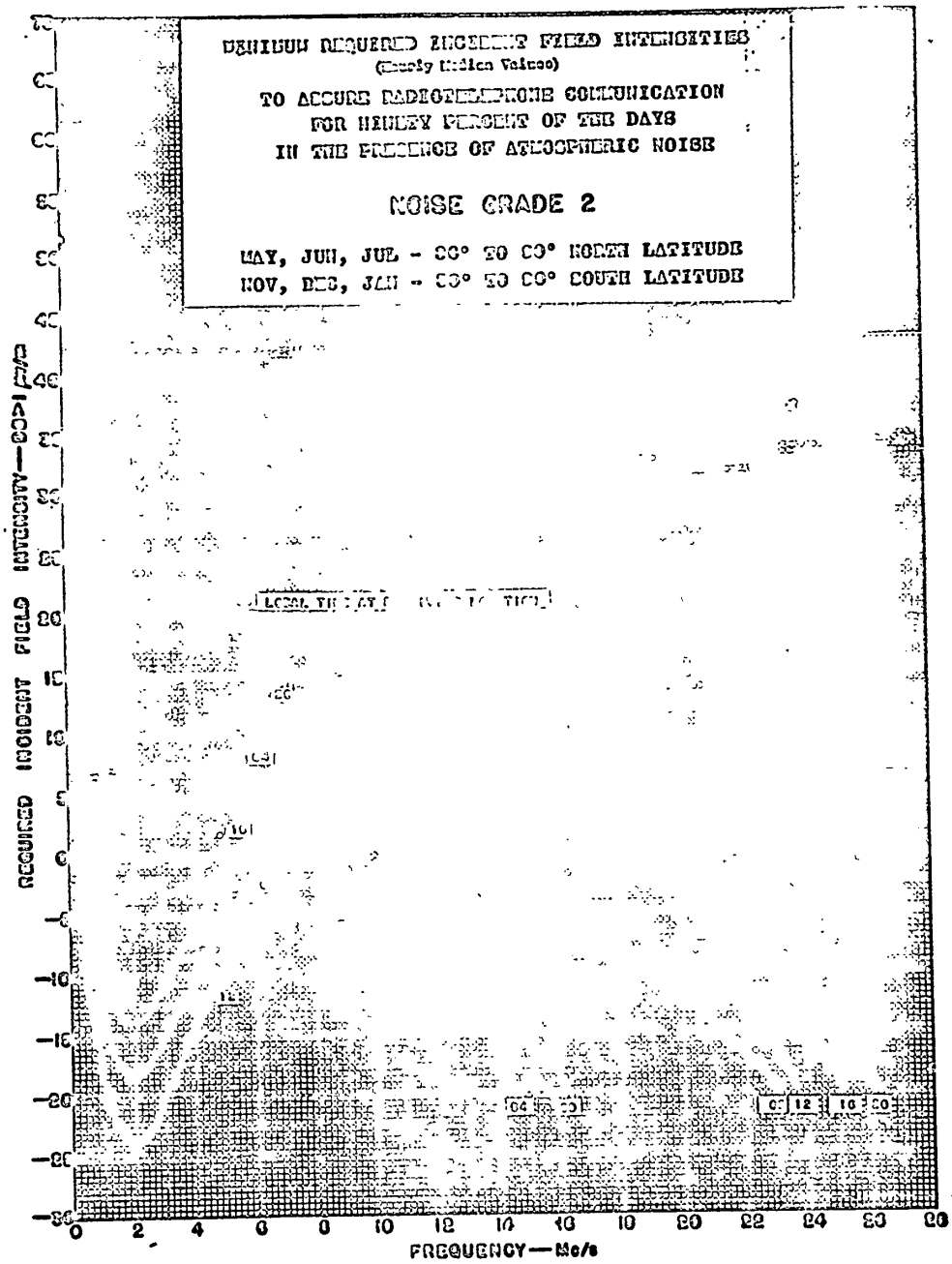

Figure 11

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Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR ORIGINAL

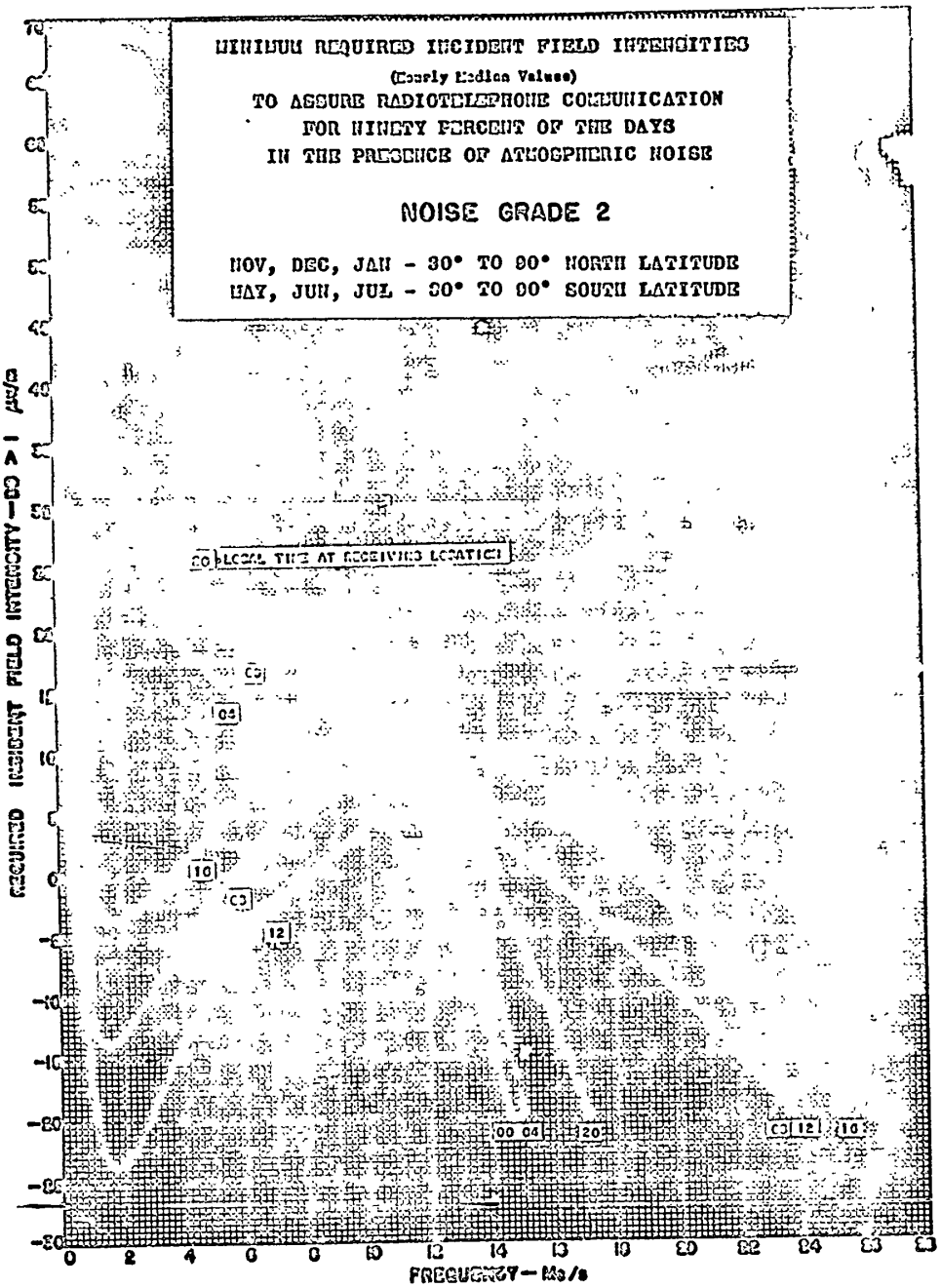

Figure 12

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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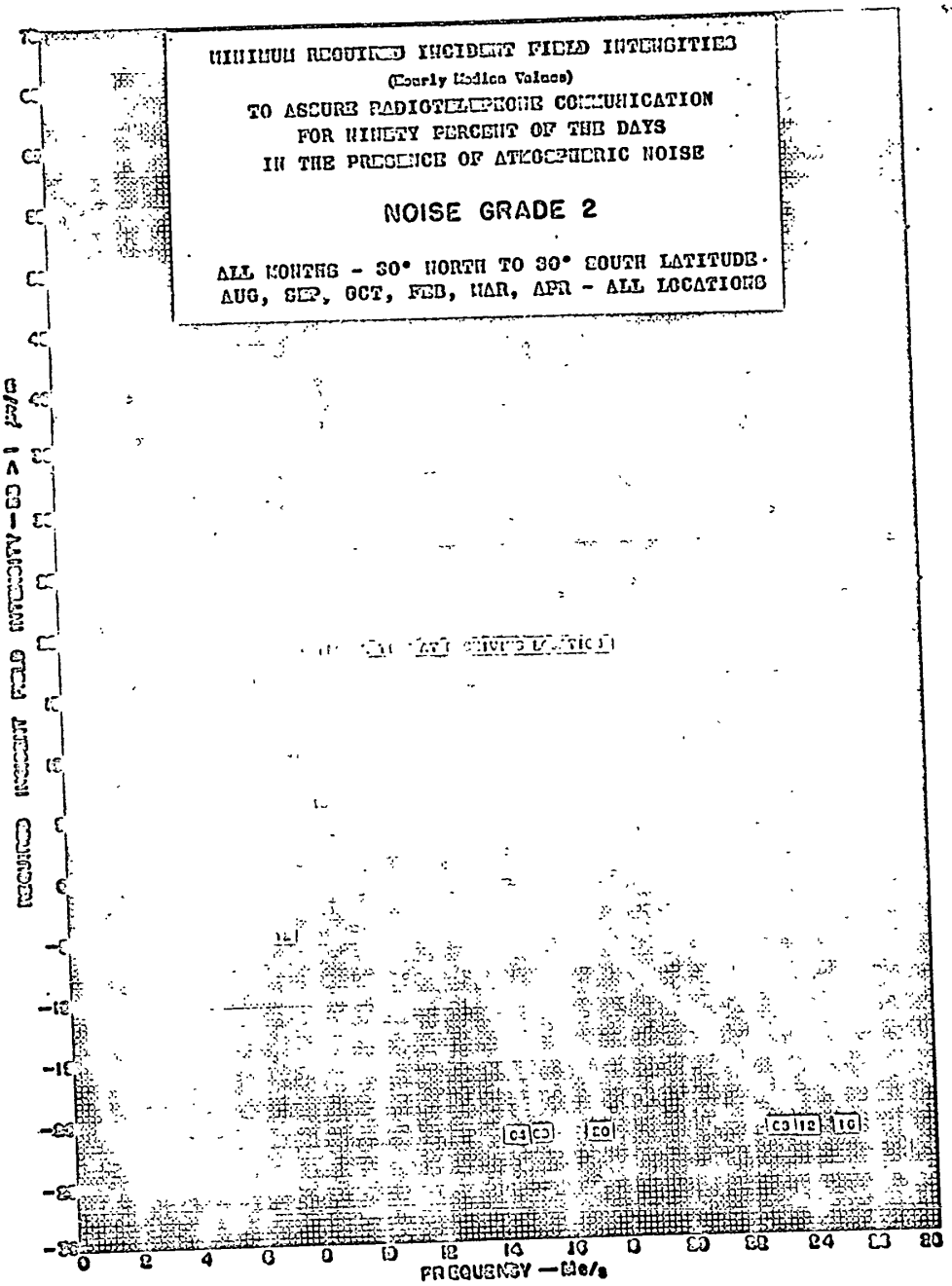

Figure 13

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

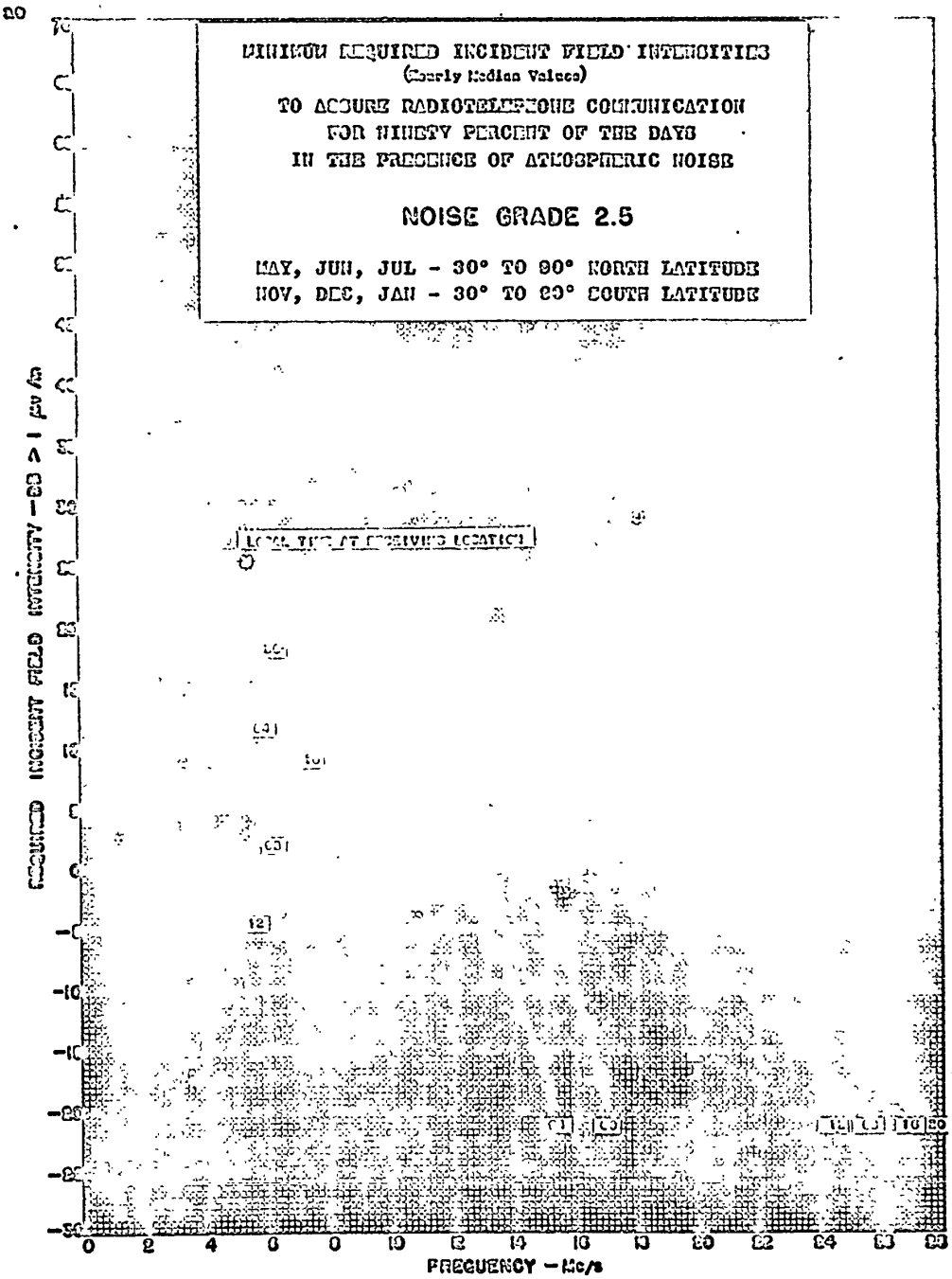

Figure 14

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR ORIGINAL

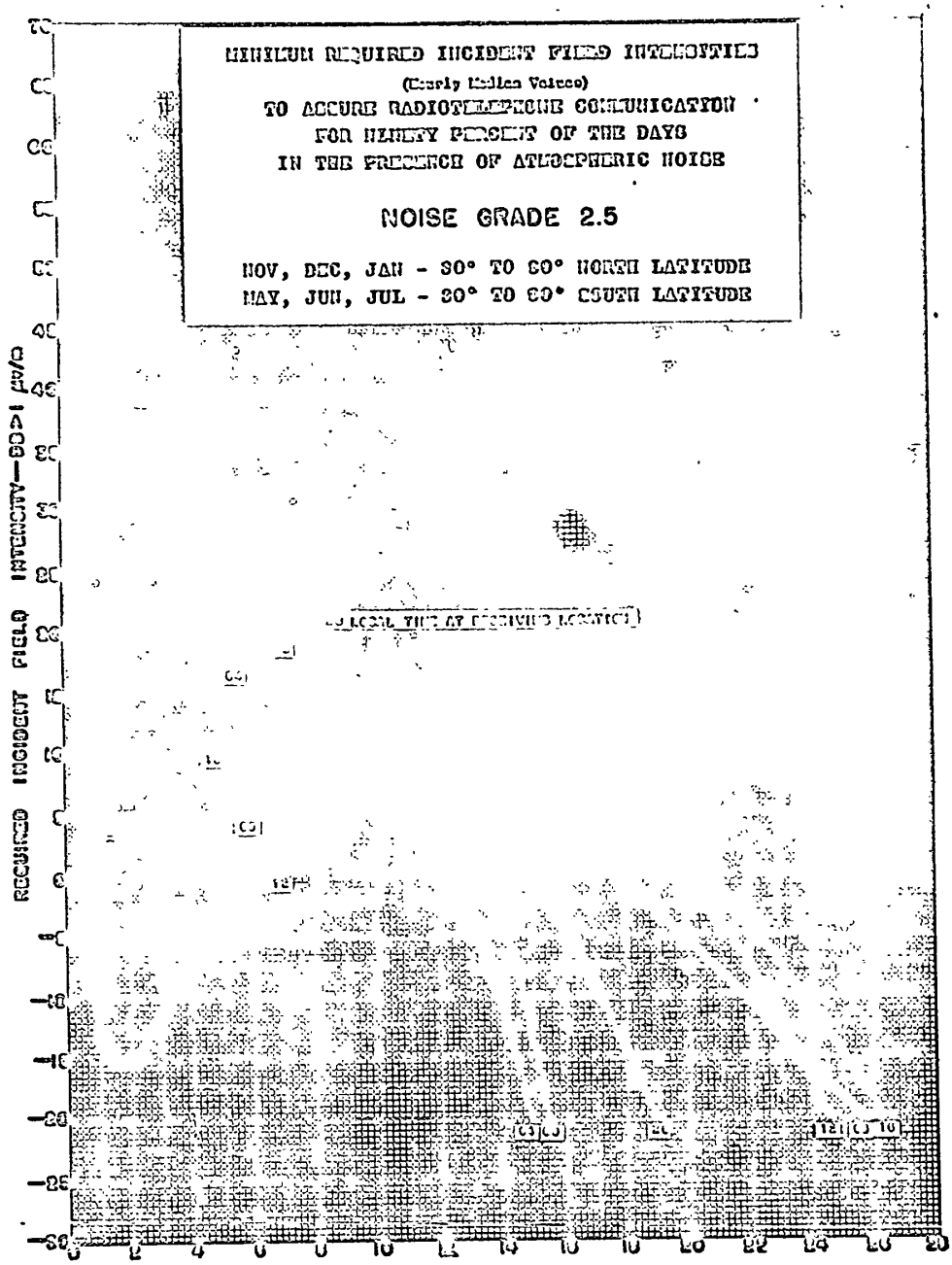

Figure 15

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR

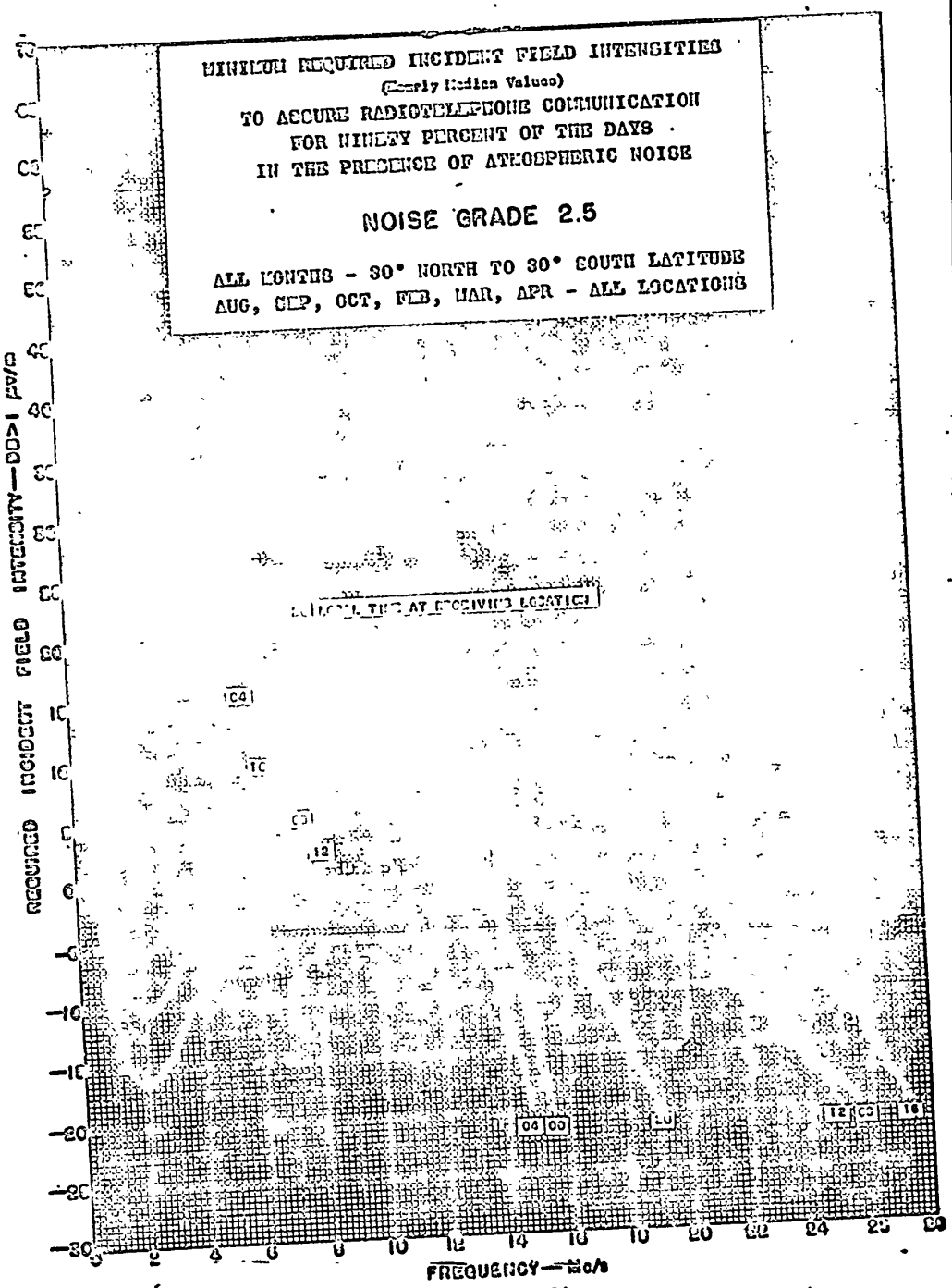

Figure 16

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR ORIGINAL

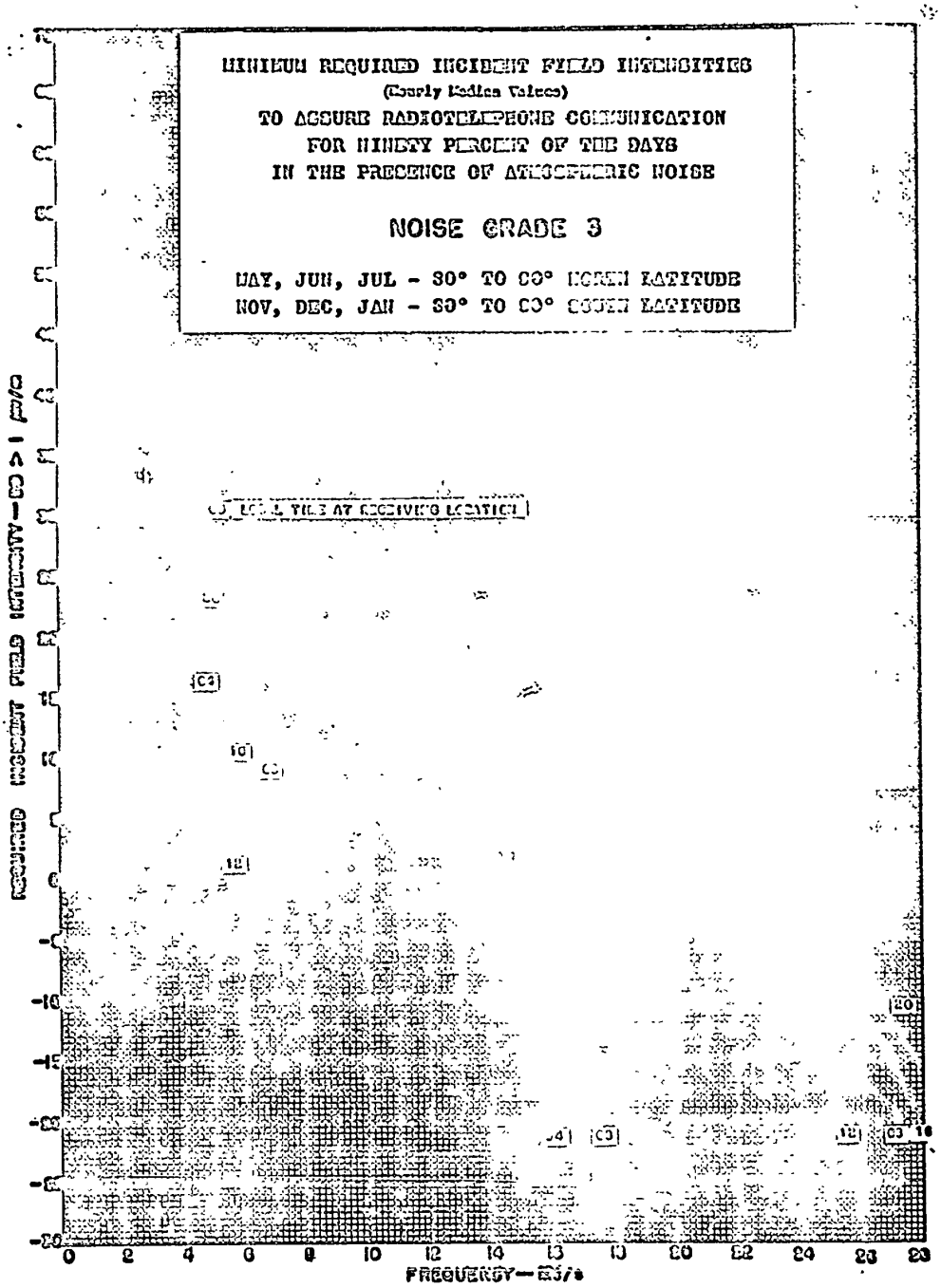

Figure 17

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR ORIGINAL

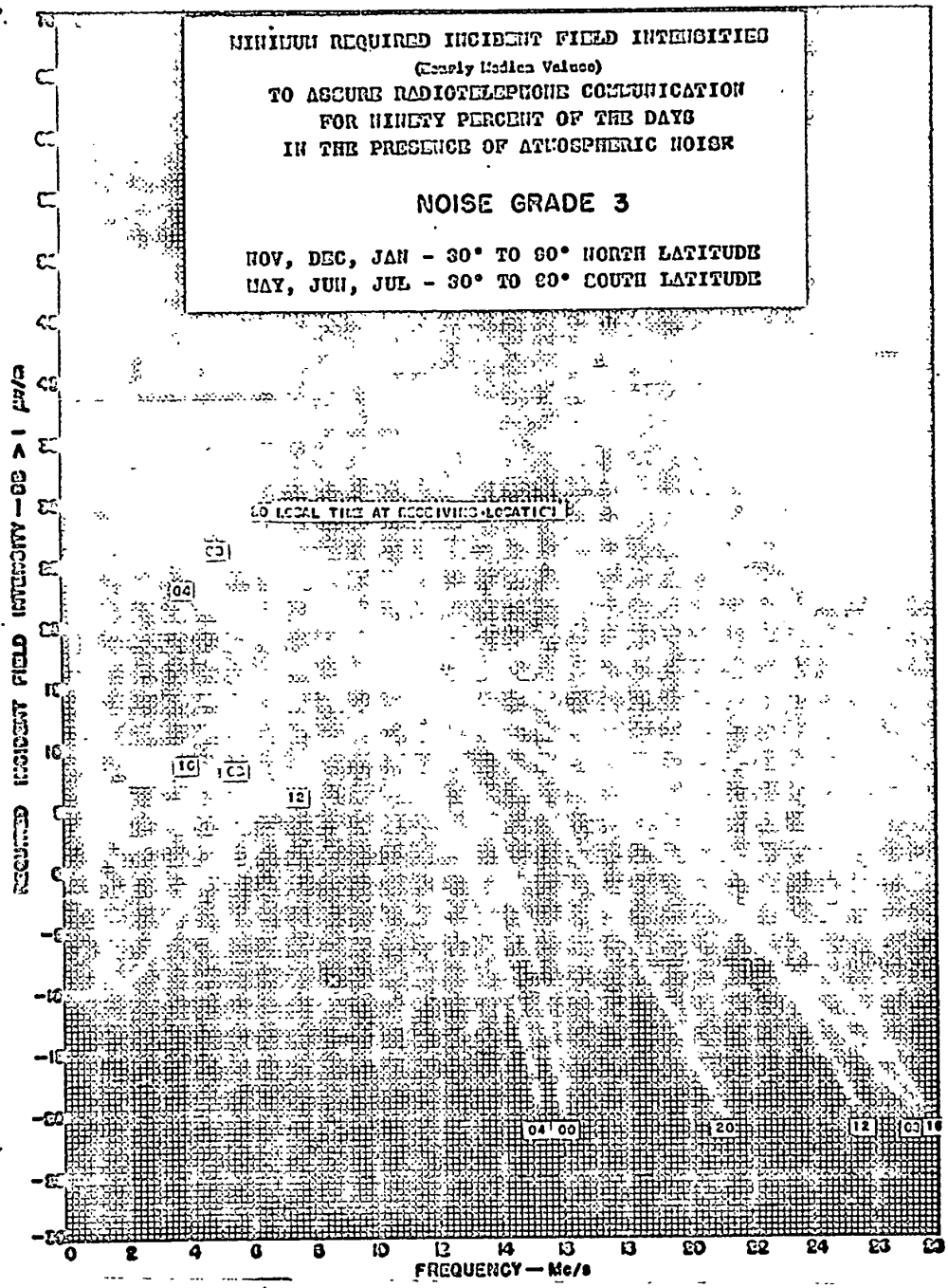

Figure 18

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

POOR ORIGINAL

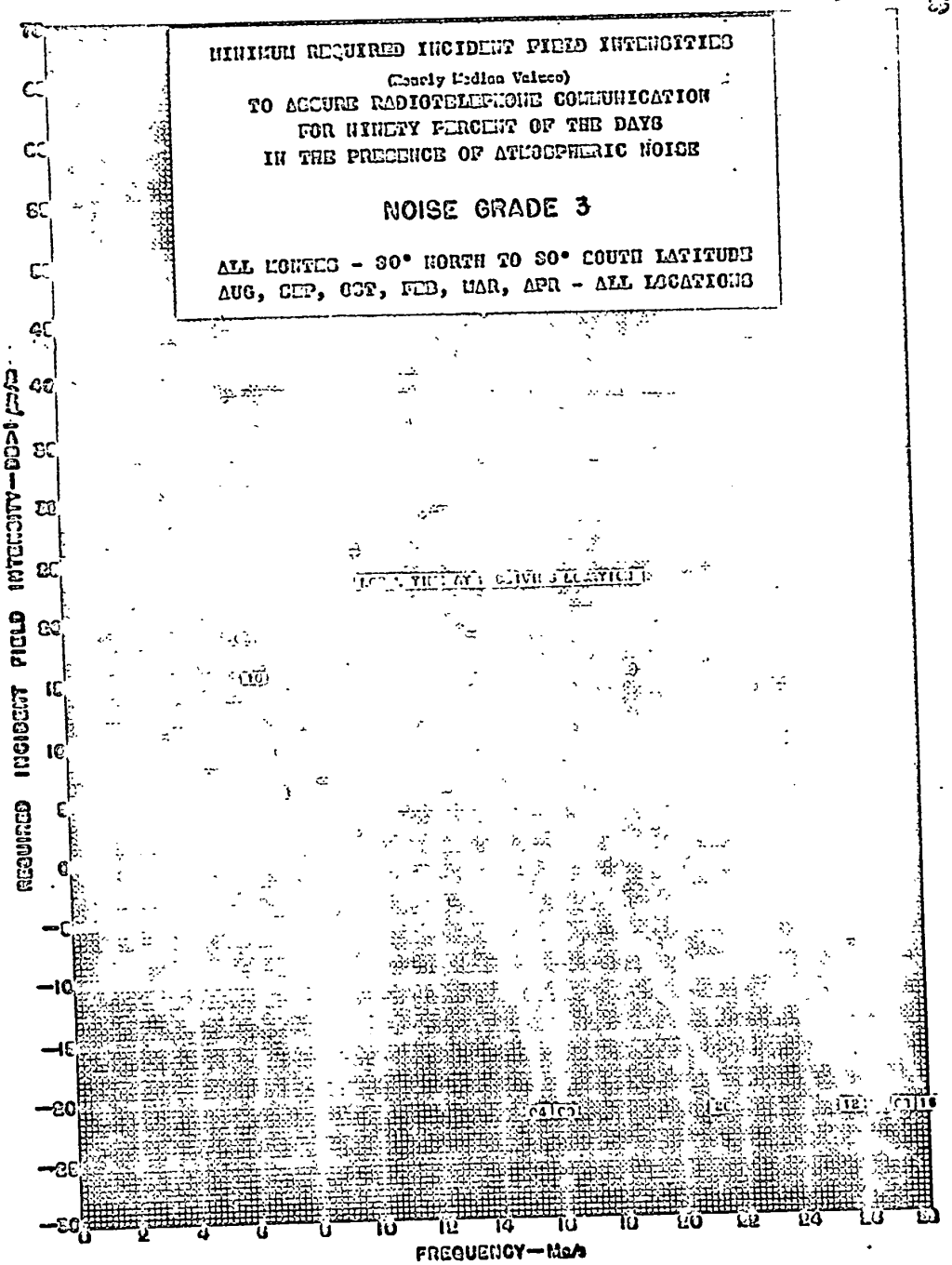

Figure 19

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

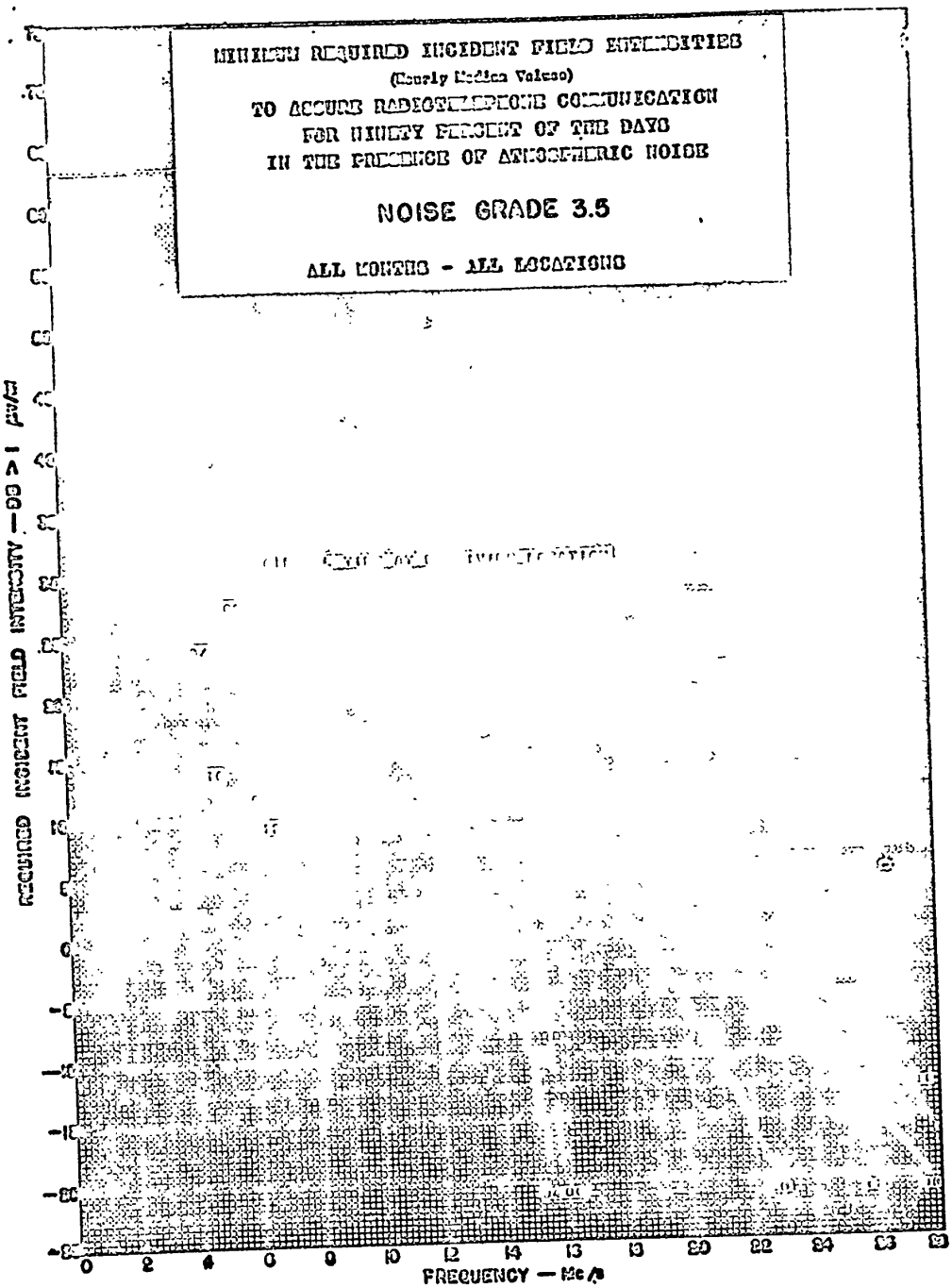

Figure 20.

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

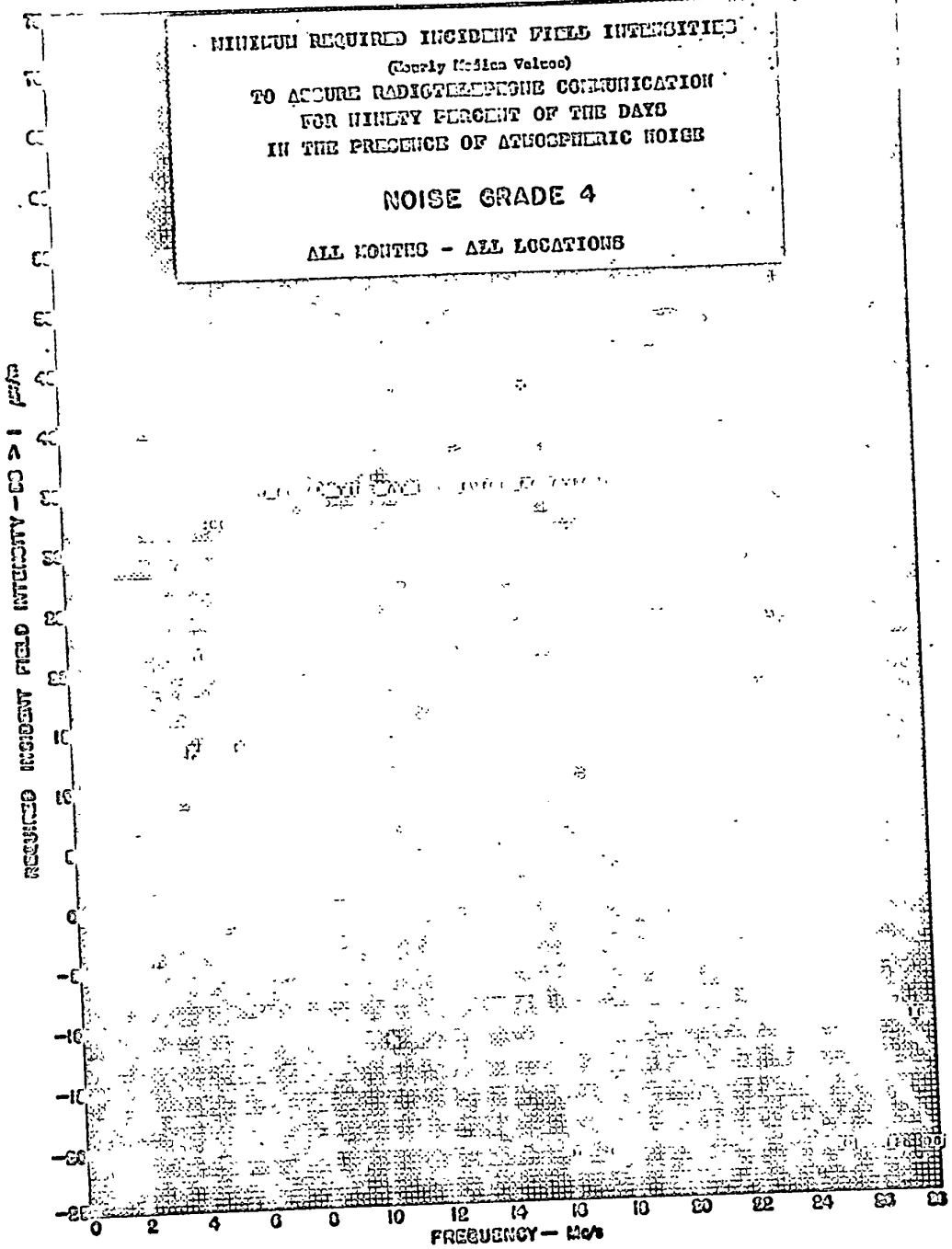

Figure 21

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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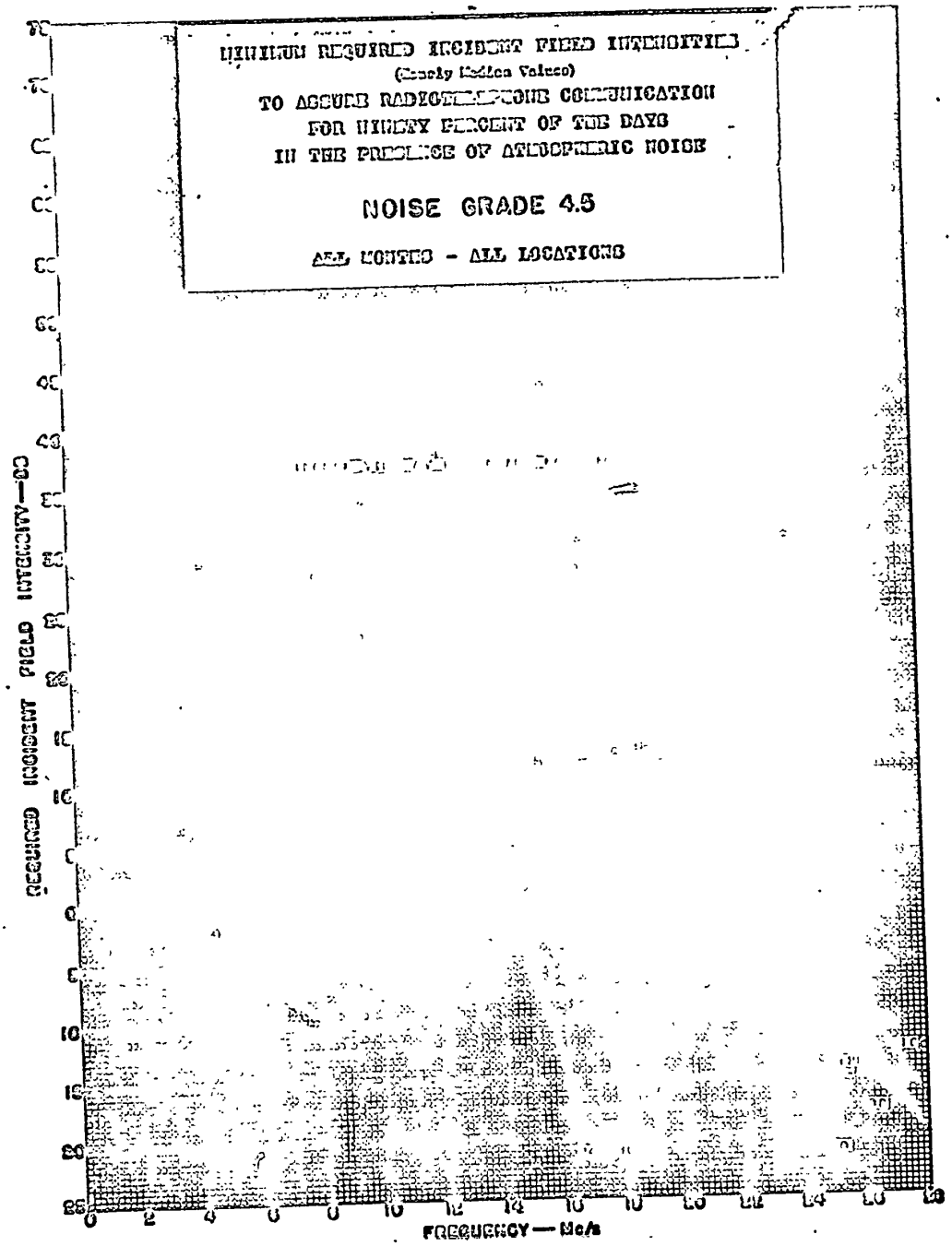

Figure 22

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

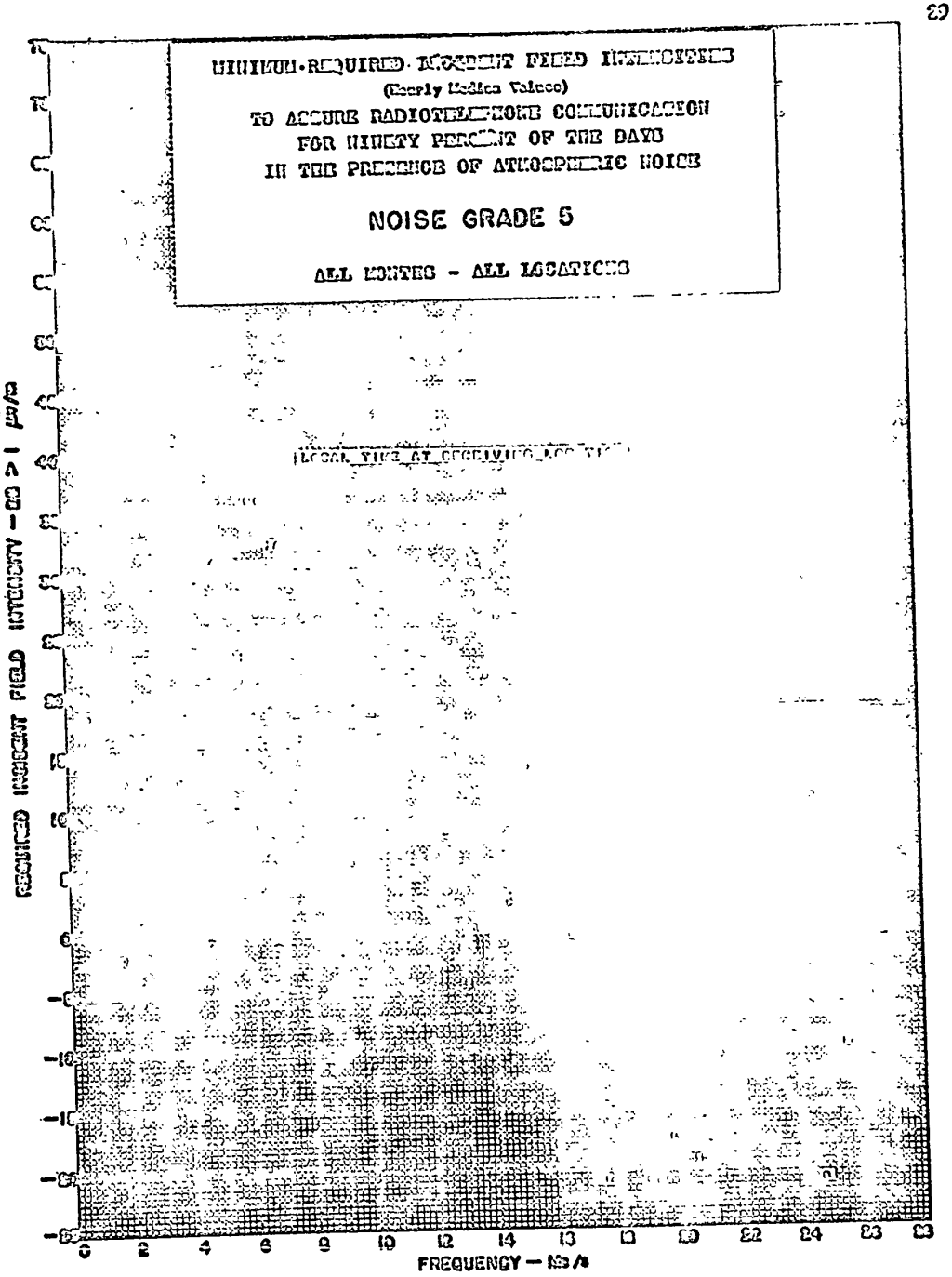

Figure 23

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED GROUND-WAVE FIELD INTENSITY
(HOURLY MEDIAN VALUES)

MINIMUM REQUIRED GROUND-WAVE FIELD INTENSITY
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

VARIOUS ANTENNAS

GROUND SYSTEM IS ASSUMED TO CONSIST OF COUNTERPOISE, OR BURIED OR SURFACE RADIAL WIRES EACH EXTENDING IN LENGTH AT LEAST EQUIVALENT TO HEIGHT OF ANTENNA

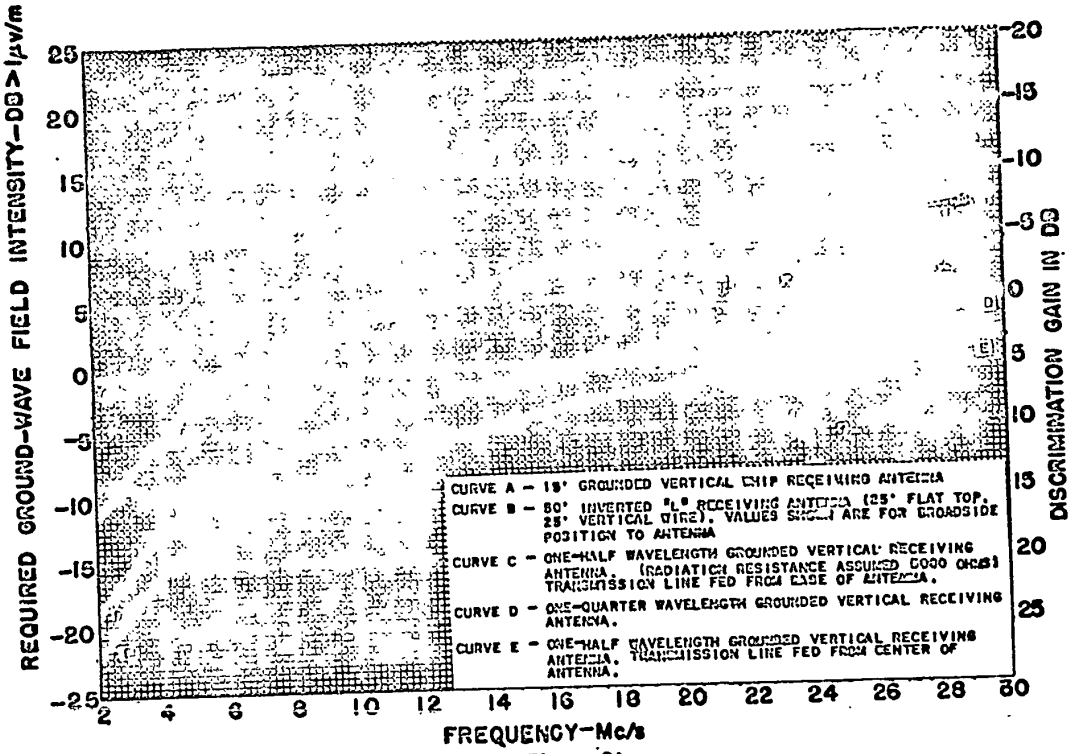

Figure 24

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICA
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/4 GROUNDED VERTICAL ANTENNA

CURVES [illegible] FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

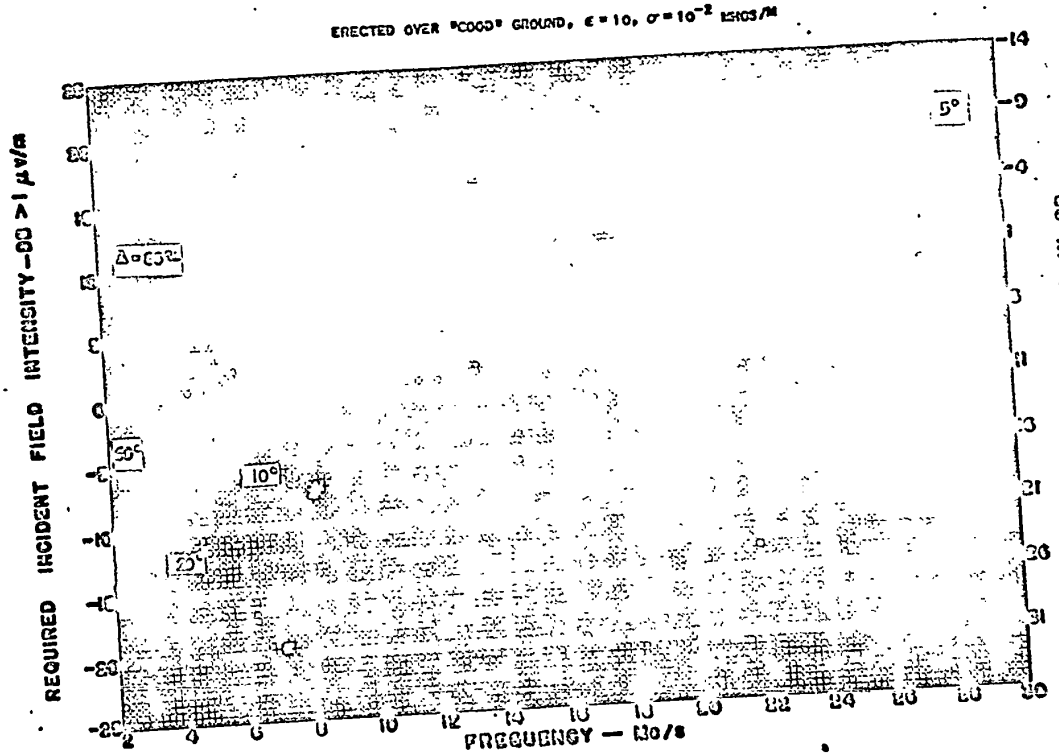

Figure 25

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/4 GROUNDED VERTICAL ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

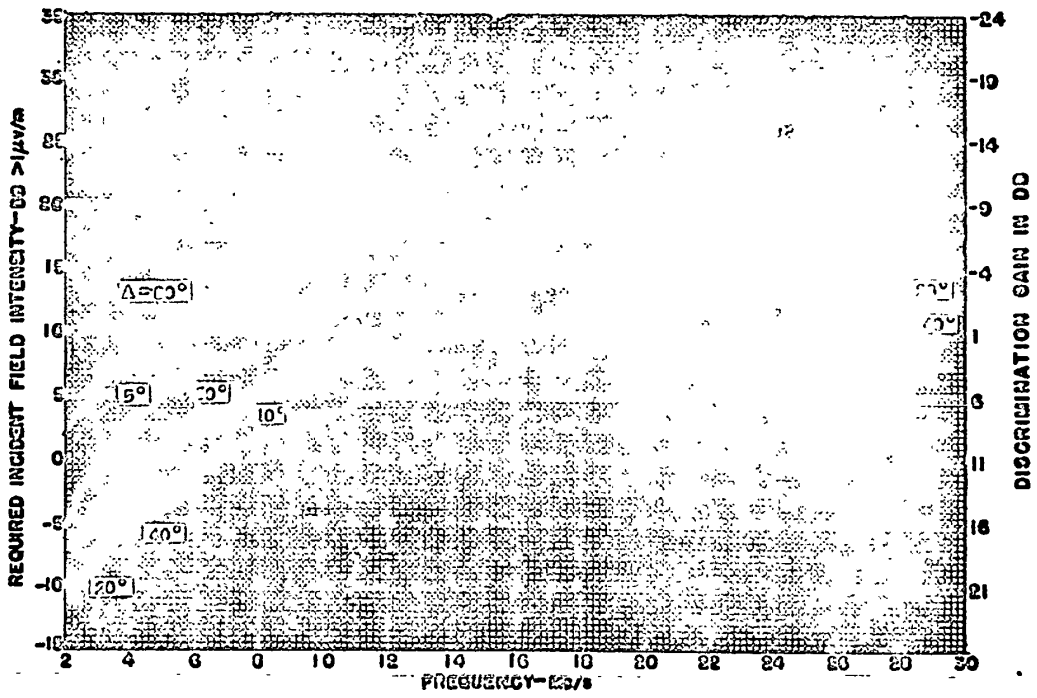

Figure 26

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 GROUNDED VERTICAL ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
TRANSMISSION LINE FED FROM CENTER OF ANTENNA

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

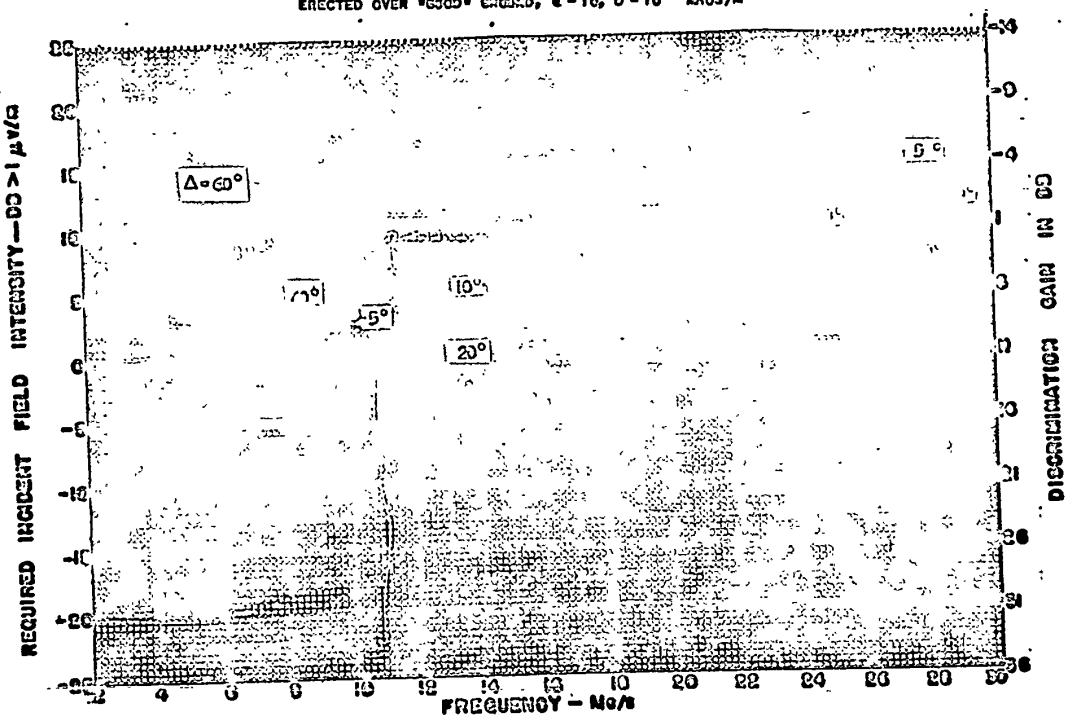

Figure 27

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 GROUNDED VERTICAL ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
TRANSMISSION LINE FED FROM CENTER OF ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

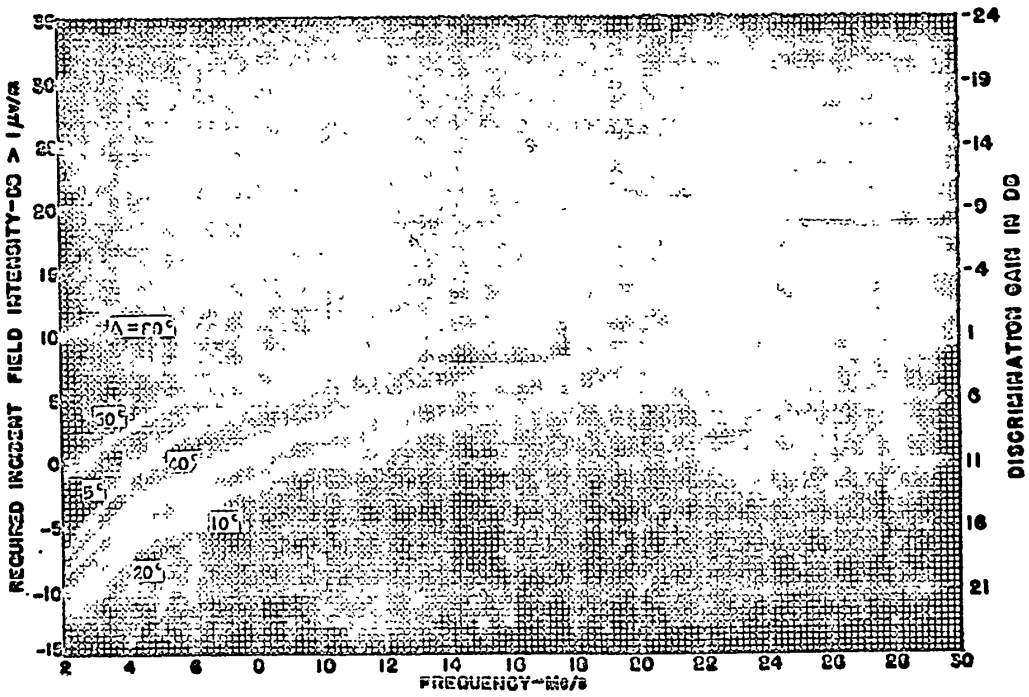

Figure 28

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 GROUNDED VERTICAL ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
TRANSMISSION LINE FED FROM BASE OF ANTENNA
RADIATION RESISTANCE ASSUMED 5000 OHMS

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

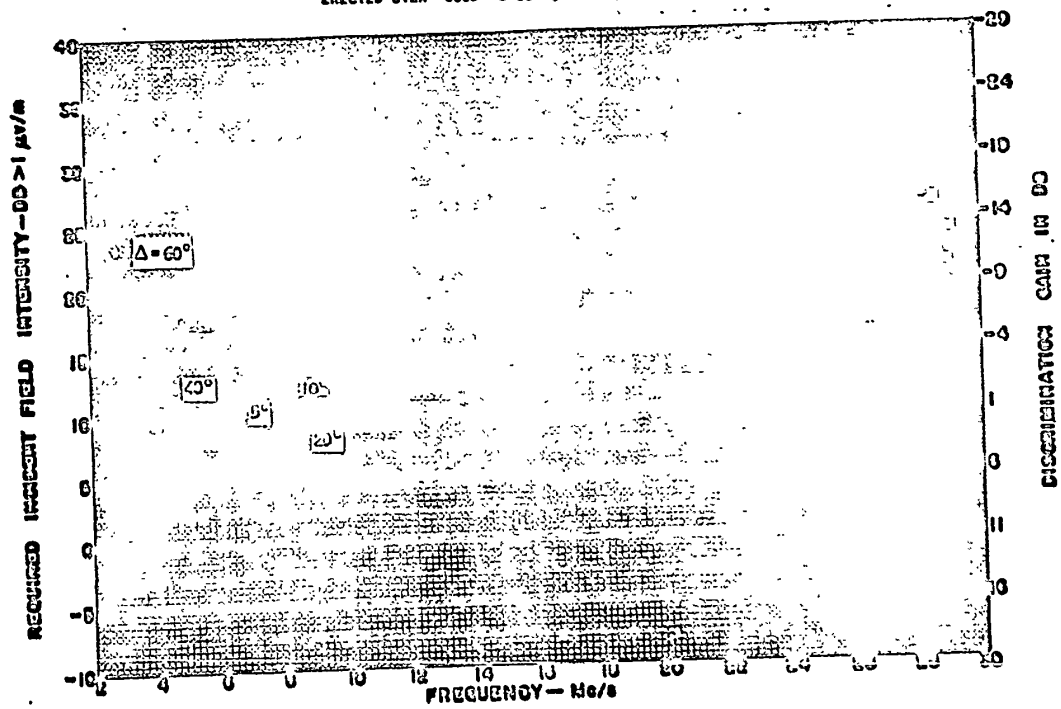

Figure 29

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 GROUNDED VERTICAL ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
TRANSMISSION LINE FED FROM BASE OF ANTENNA
RADIATION RESISTANCE ASSUMED 5000 OHMS

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

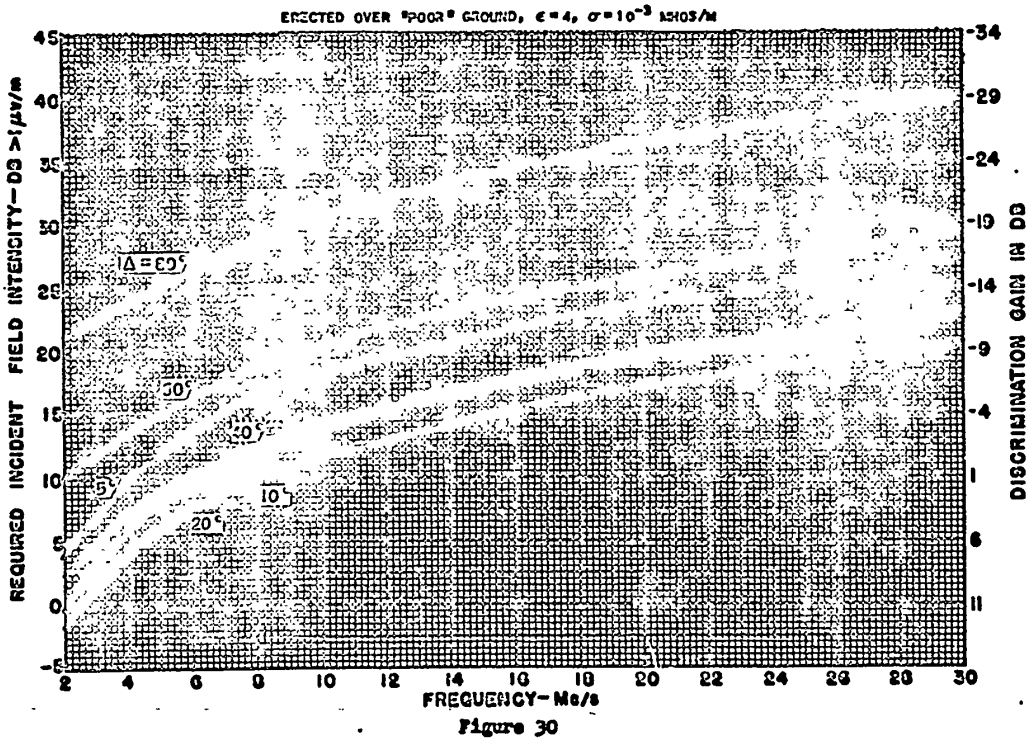

Figure 30

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

15' WHIP ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

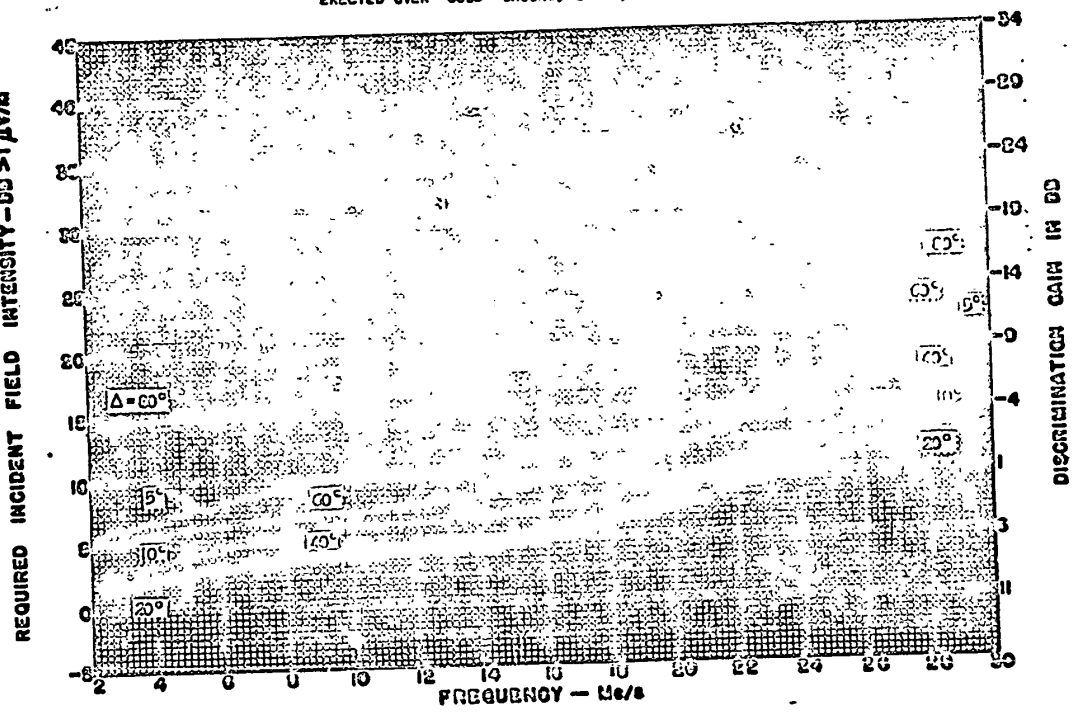

Figure 31

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

15' WHIP ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

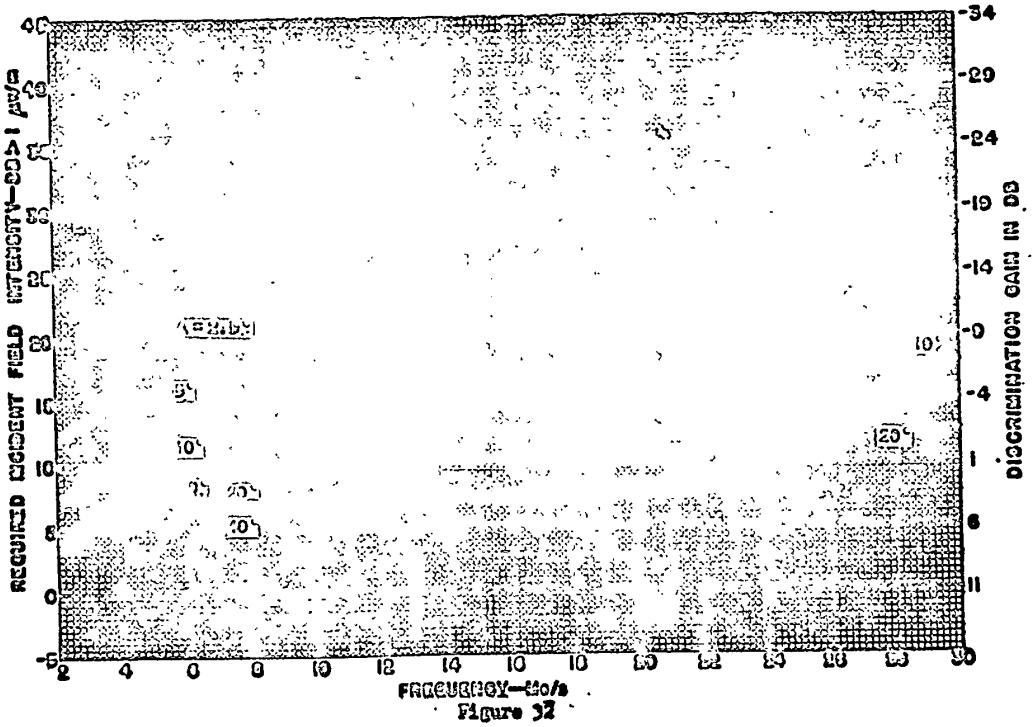

Figure 32

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

50' INVERTED "L" ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

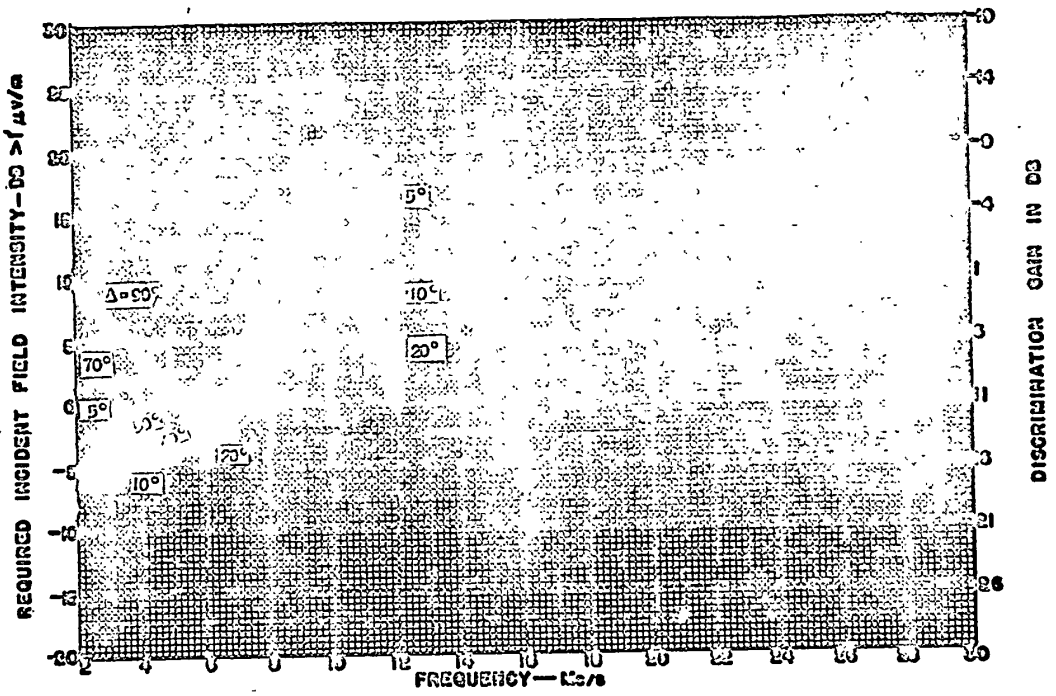

Figure 33

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

50' INVERTED "L" ANTENNA

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

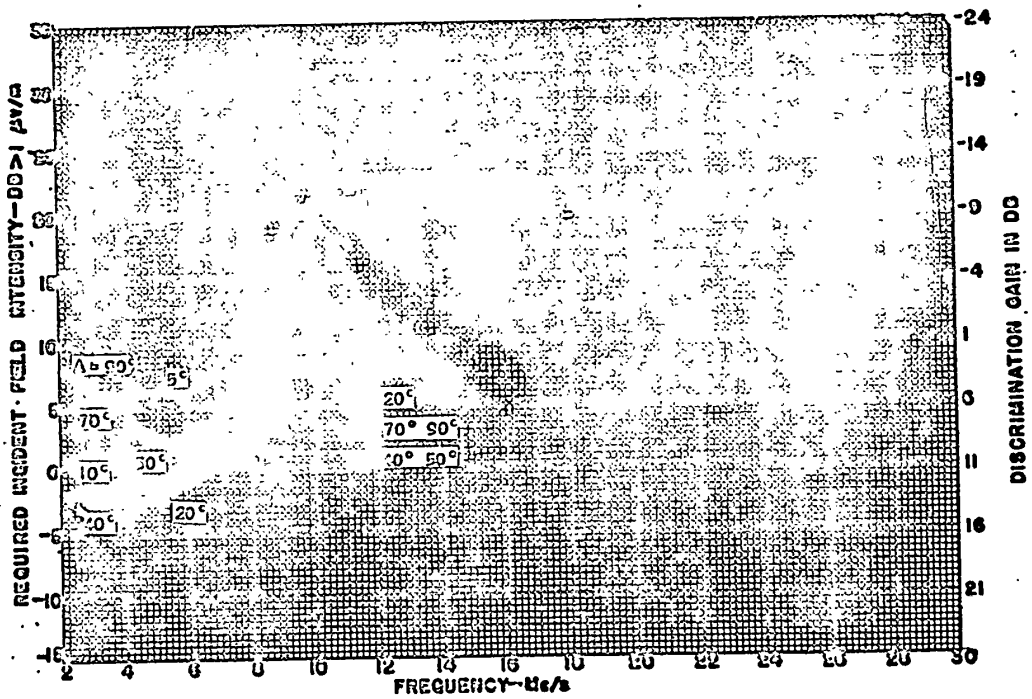

Figure 34

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA λ/4 HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHO/M

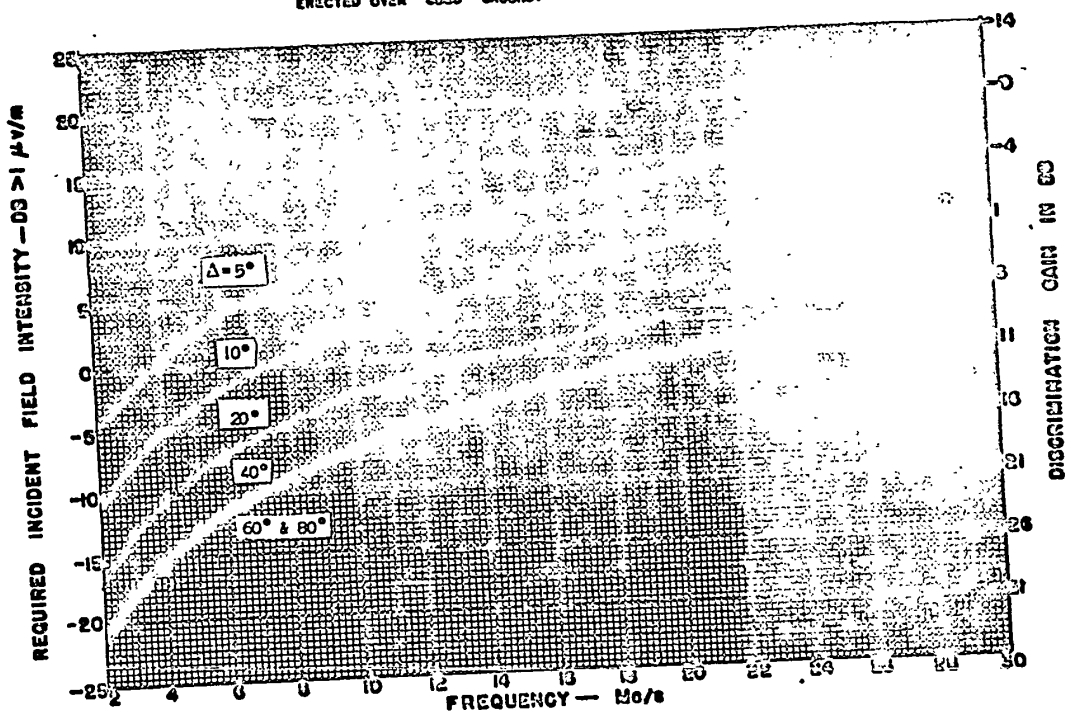

Figure 35

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA λ/4 HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

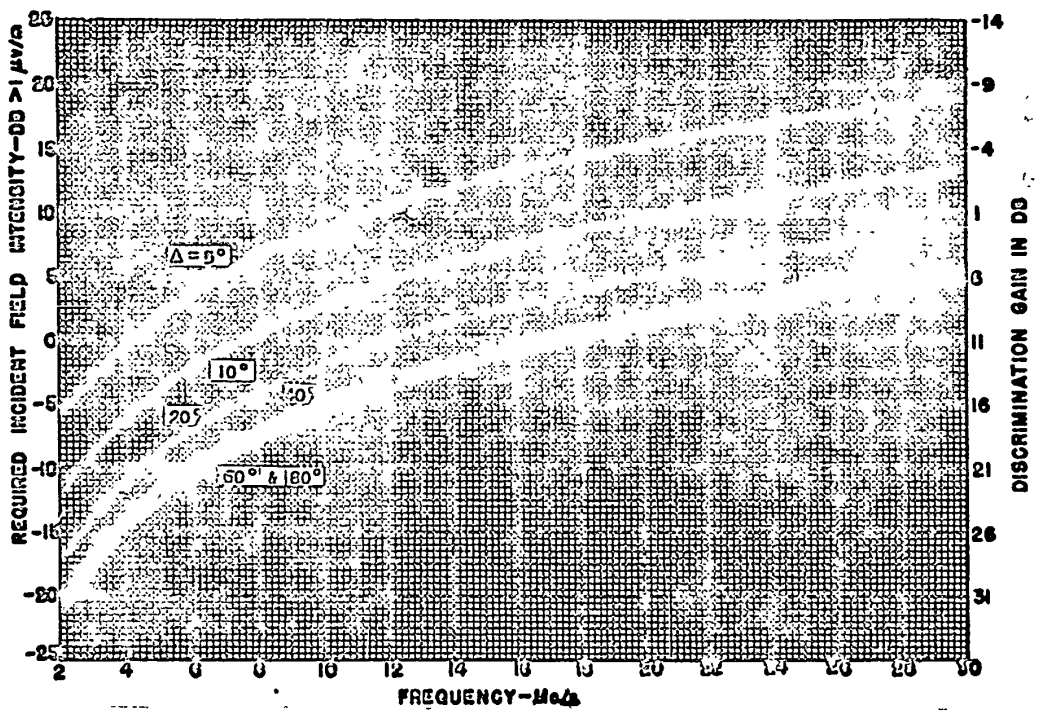

Figure 36

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 10' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

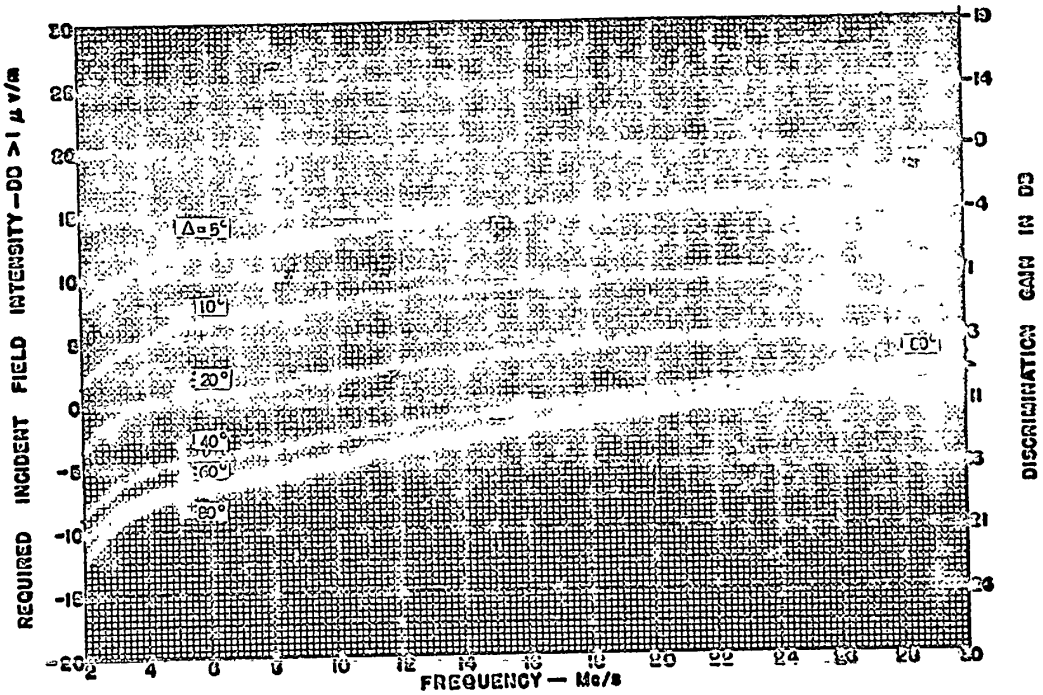

Figure 37

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 10' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

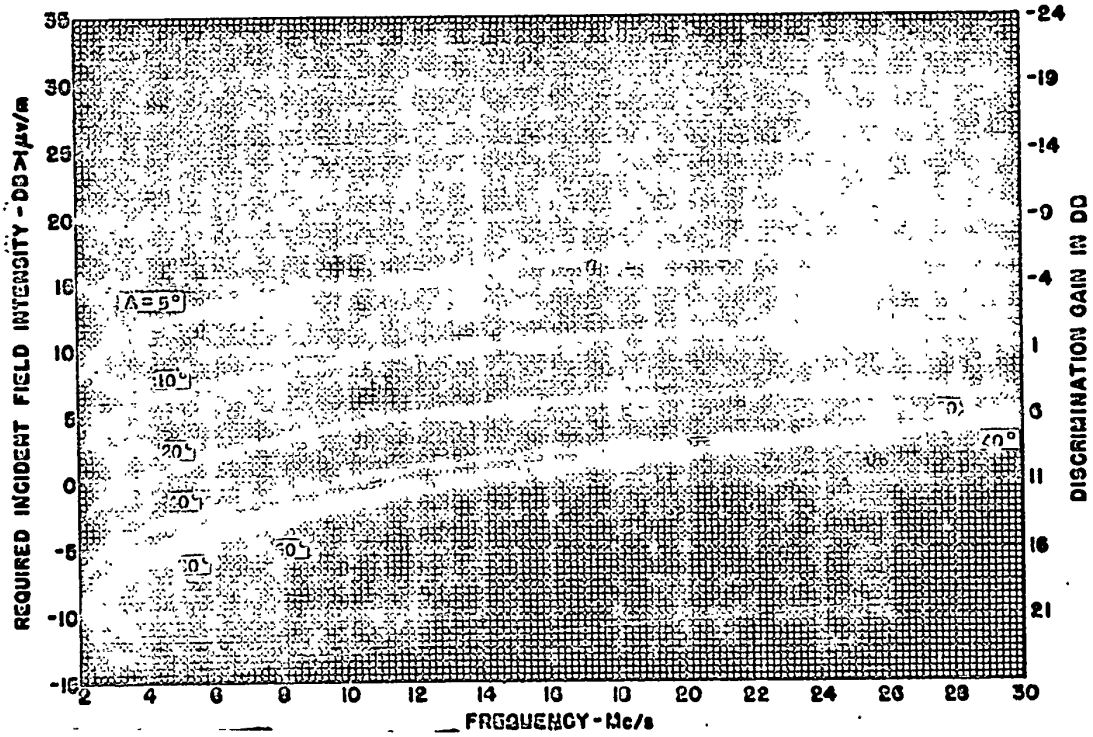

Figure 38

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 30' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA
ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

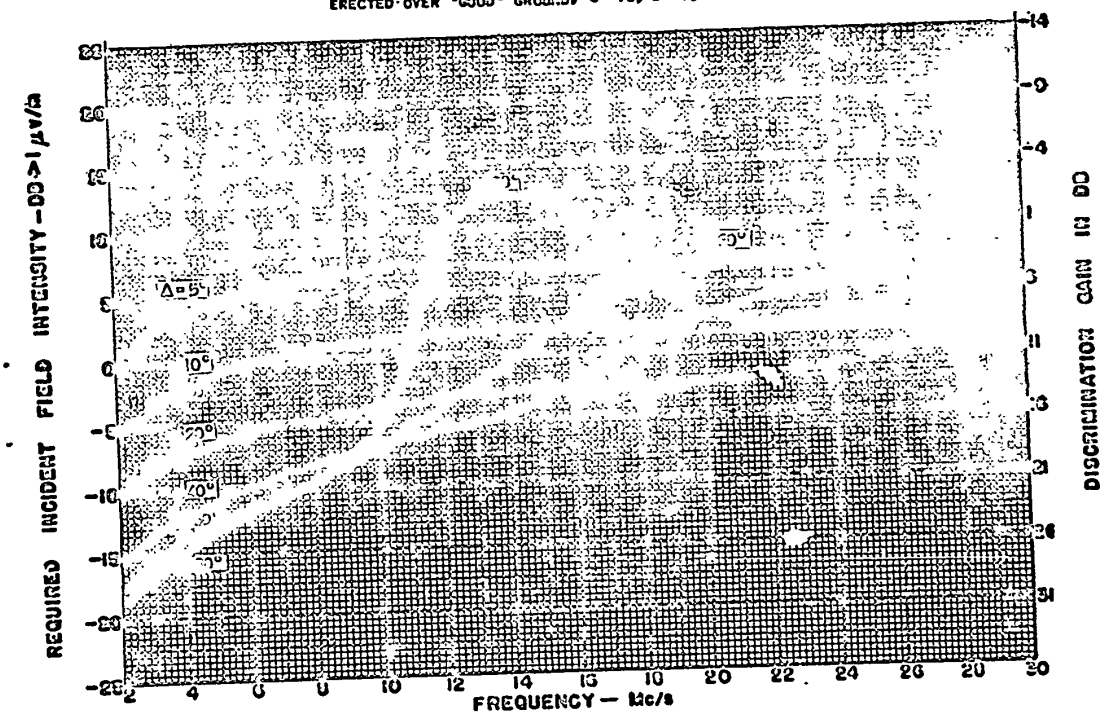

Figure 39

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 30' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

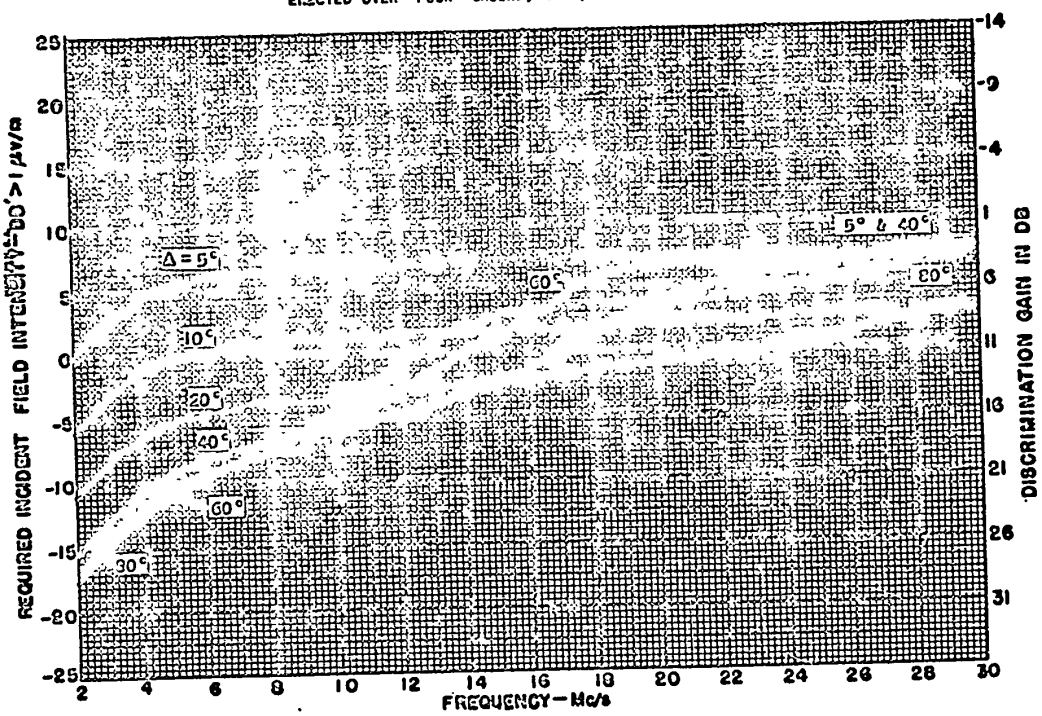

Figure 40

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 60' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

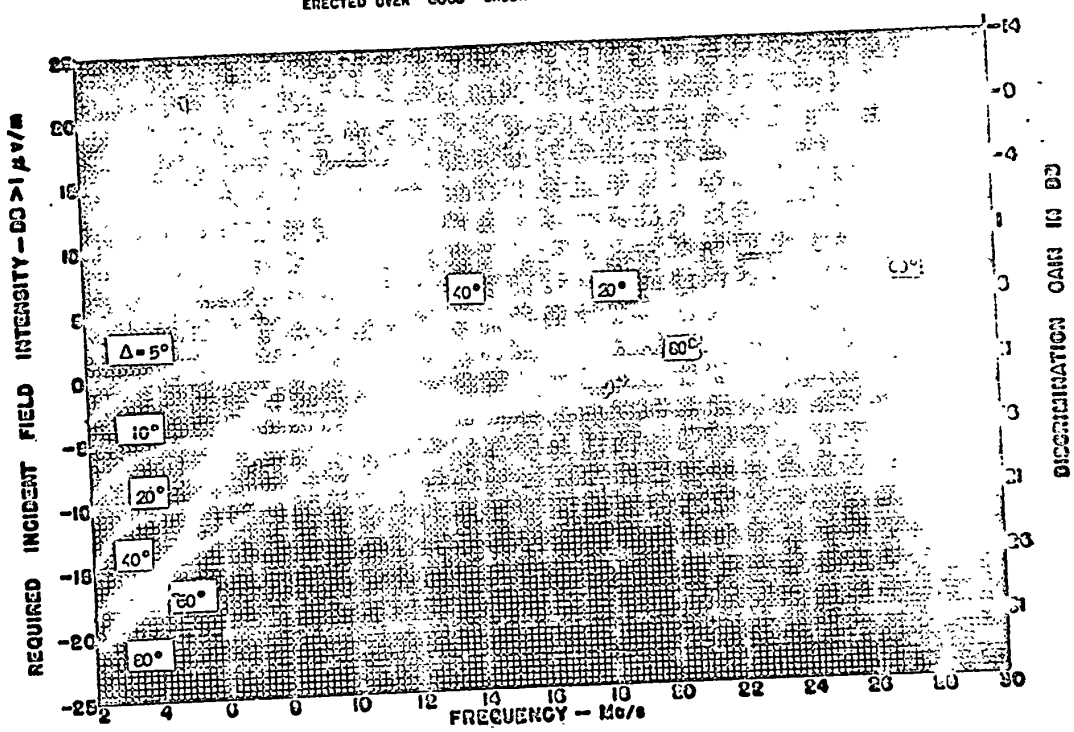

Figure 41

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

λ/2 HORIZONTAL ANTENNA 60' HIGH

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE
BROADSIDE TO THE ANTENNA

ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

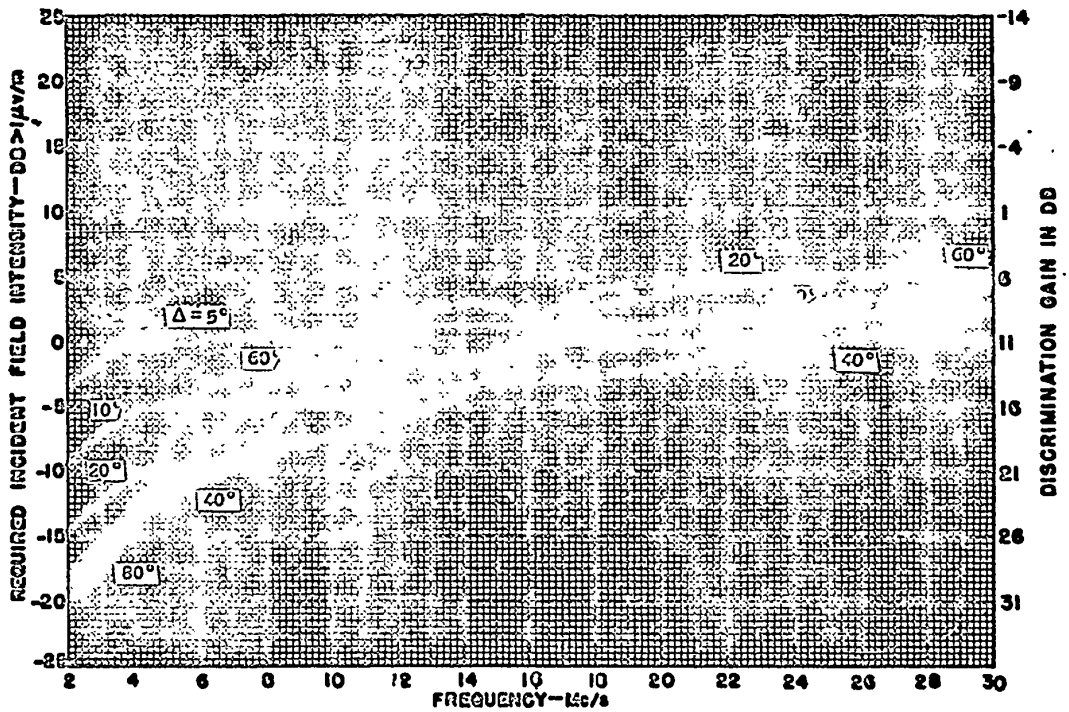

Figure 42

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Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "A"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

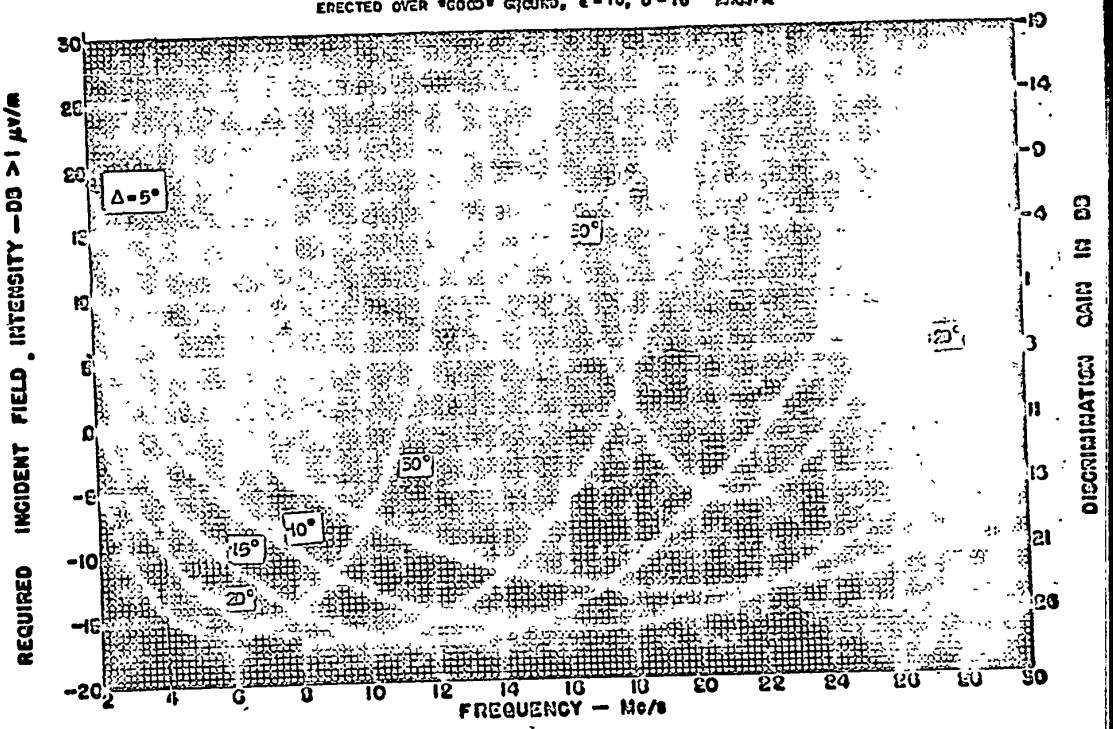

Figure 43.

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "A"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

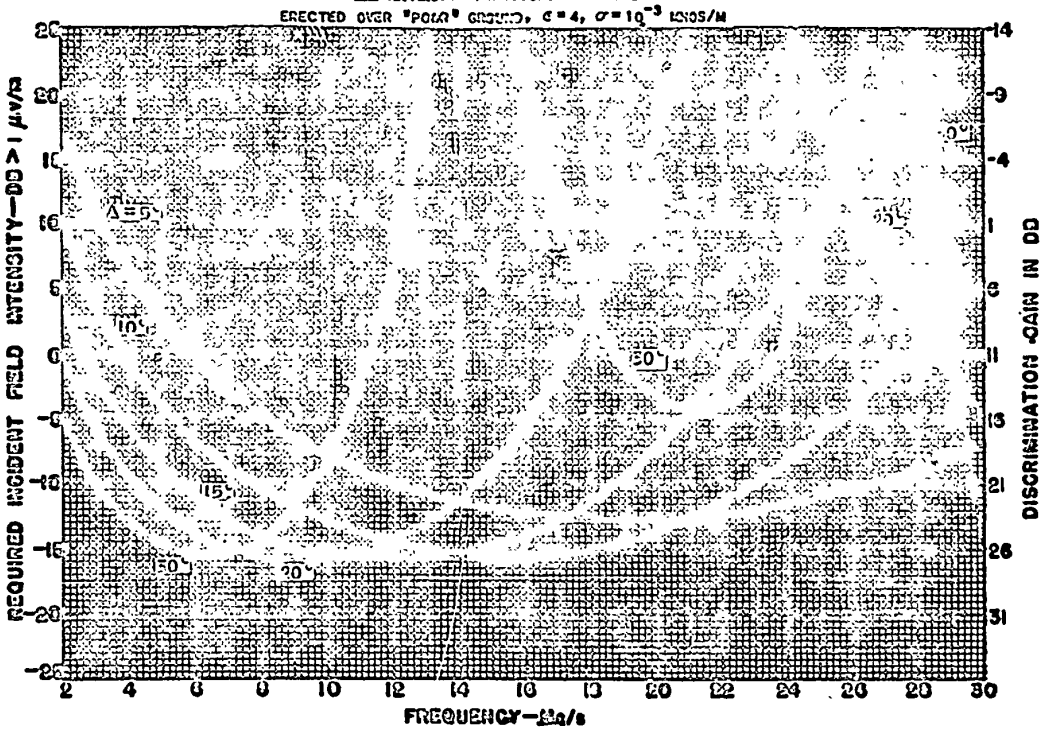

Figure 44

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "B"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

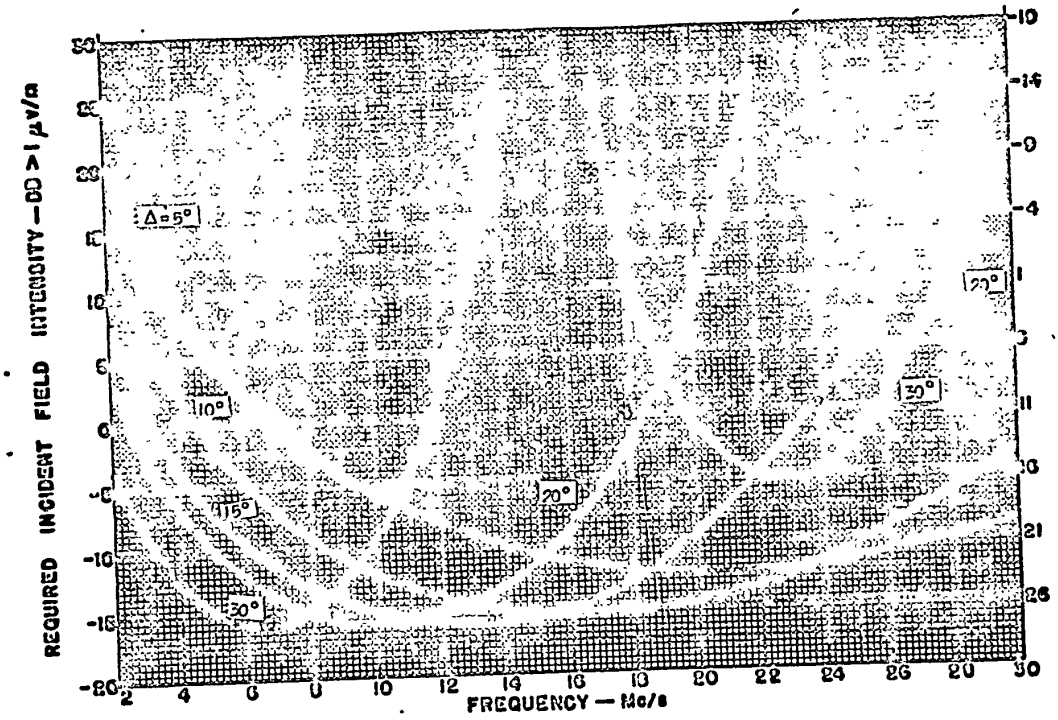

Figure 45

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "B"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

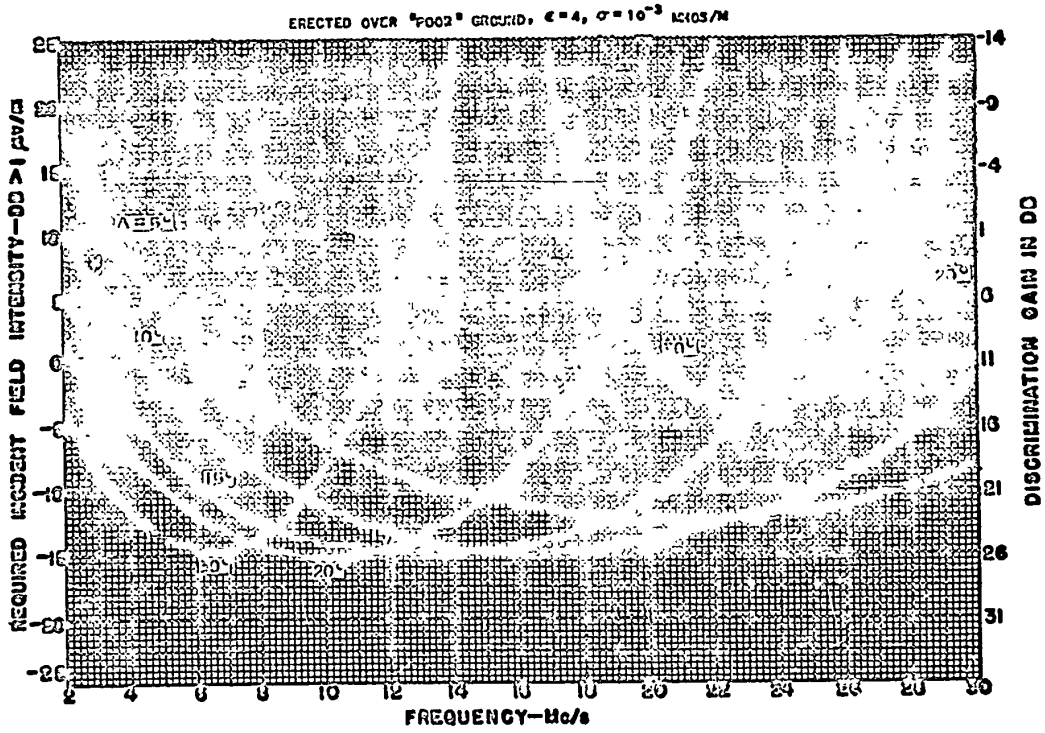

Figure 46

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "C"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

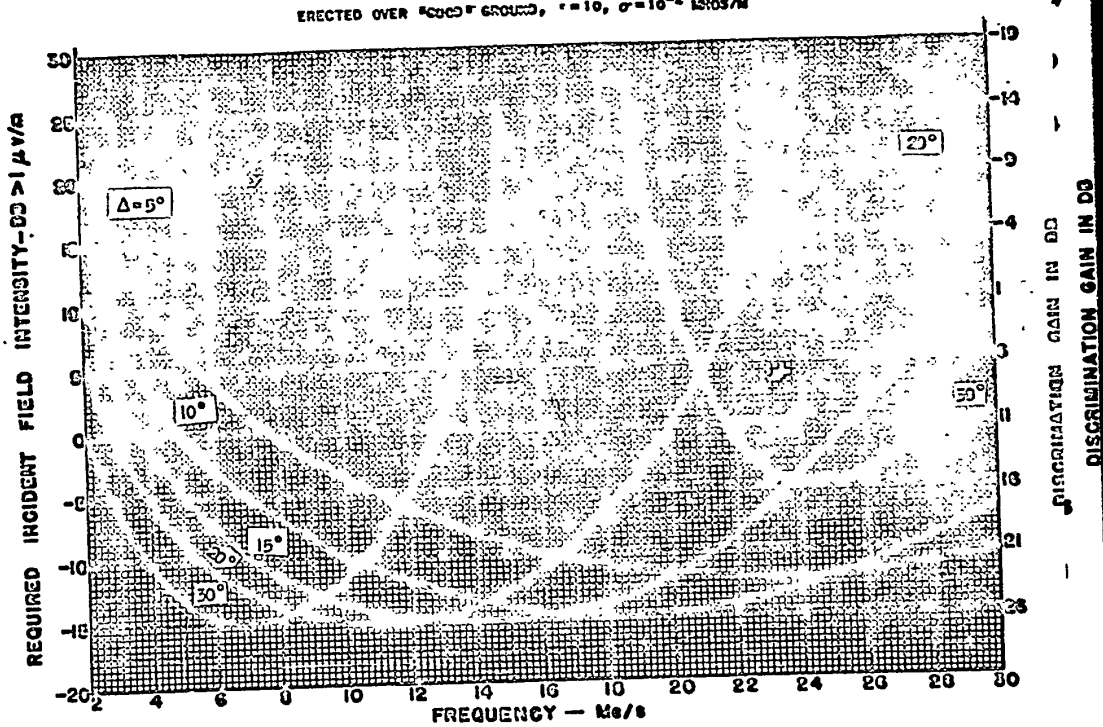

Figure 47

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "C"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

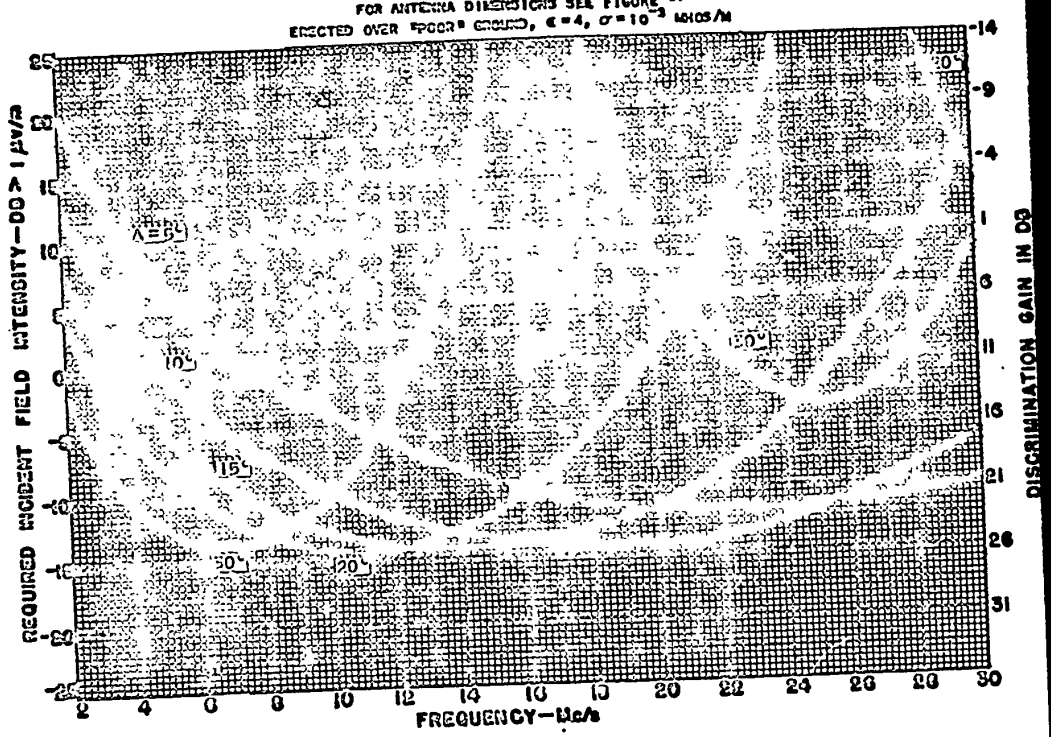

Figure 46

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION*
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "D"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

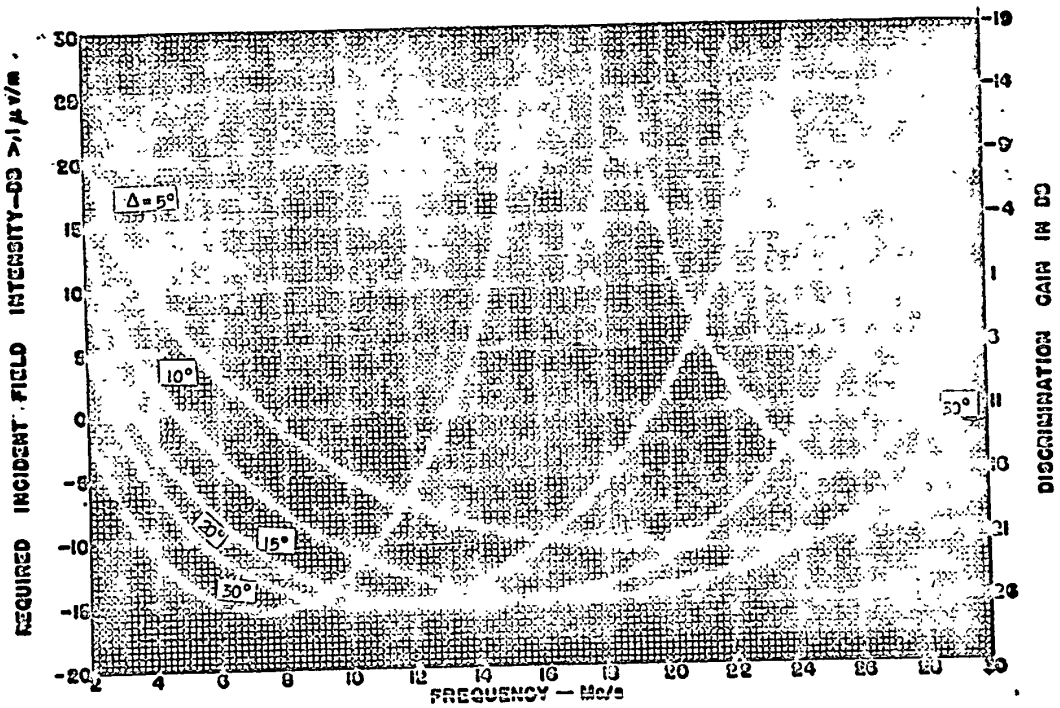

Figure 49

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "D"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

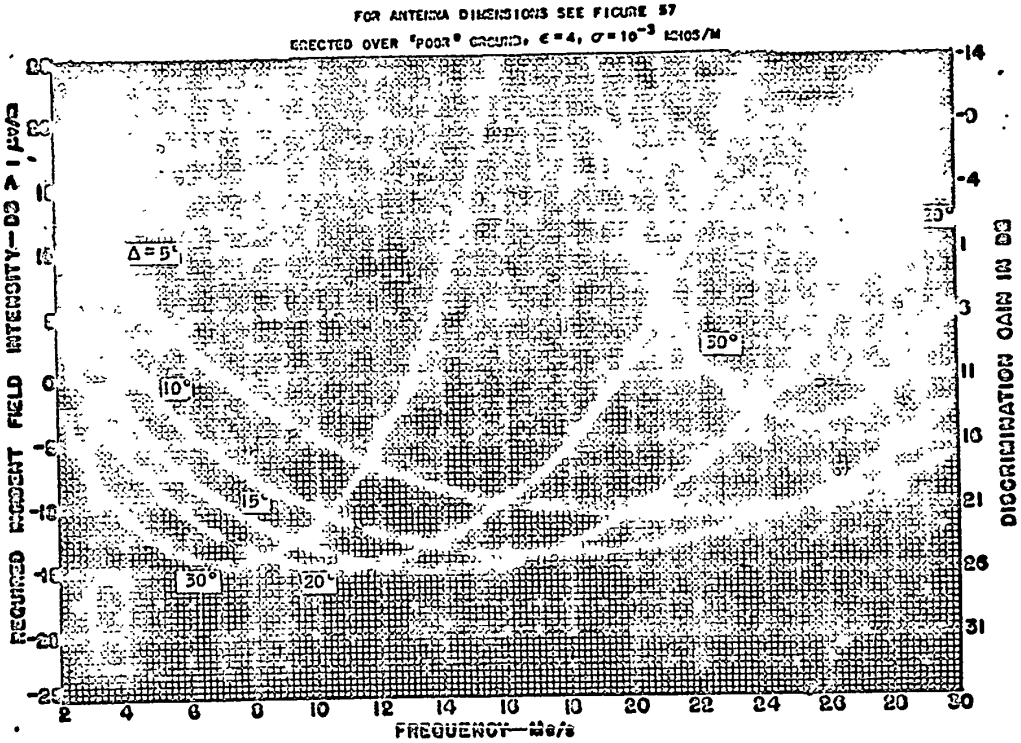

Figure 50

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MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF ATMOSPHERIC NOISE

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "E"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

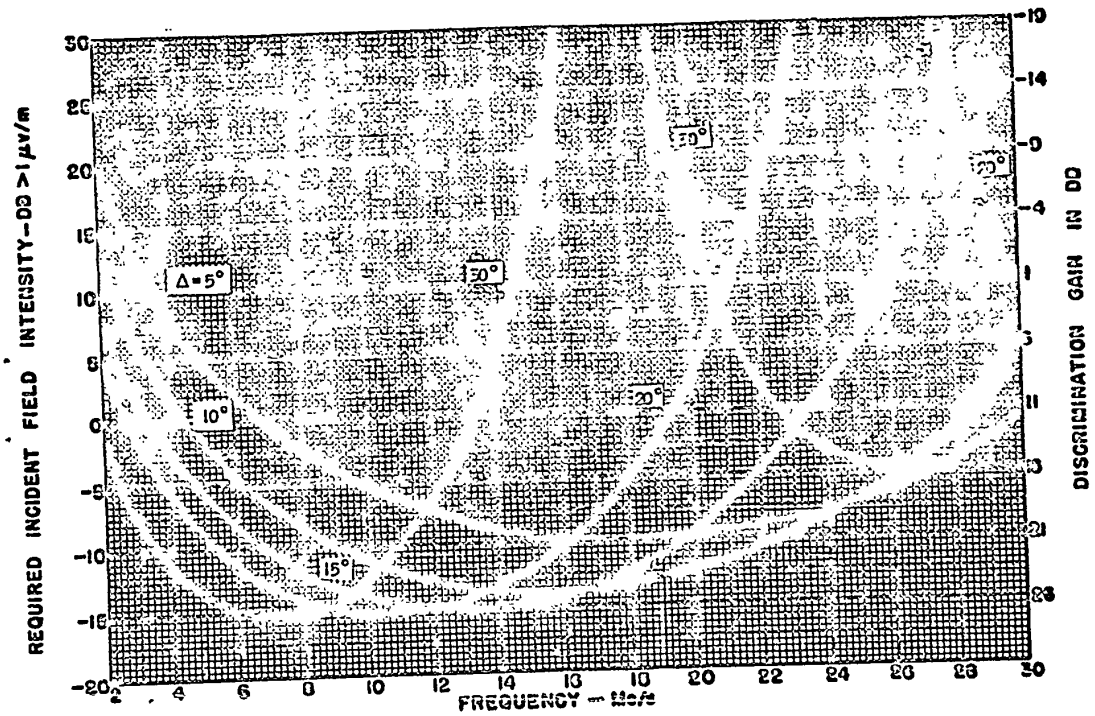

Figure 51

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "E"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

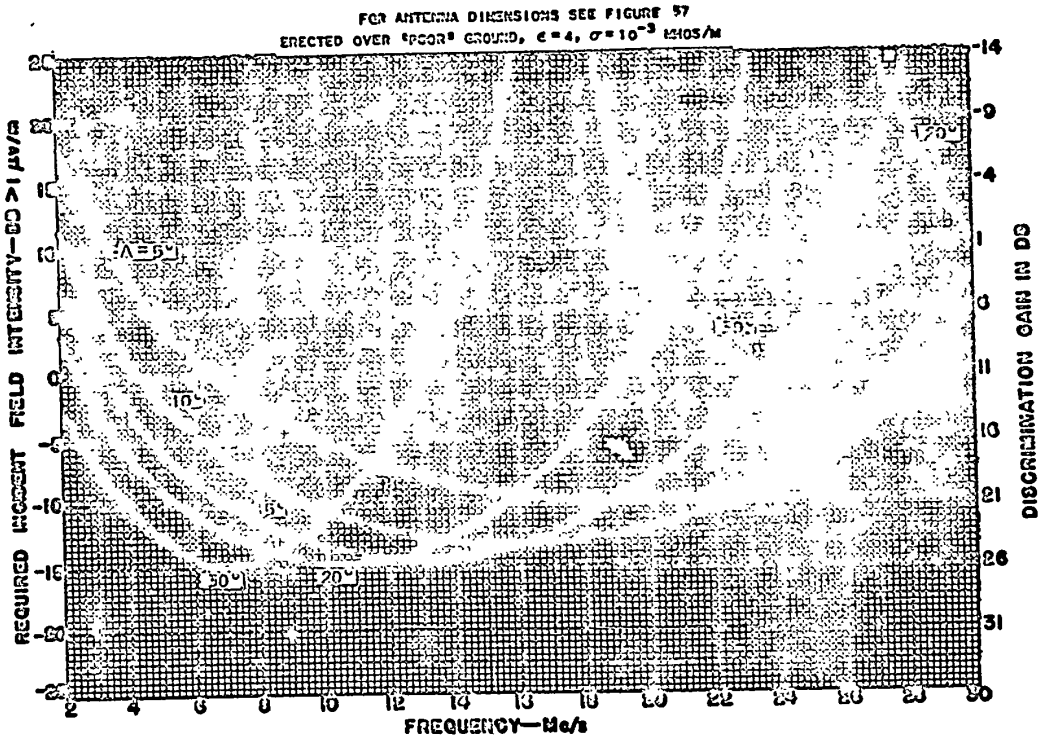

Figure 52

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES

TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "F"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

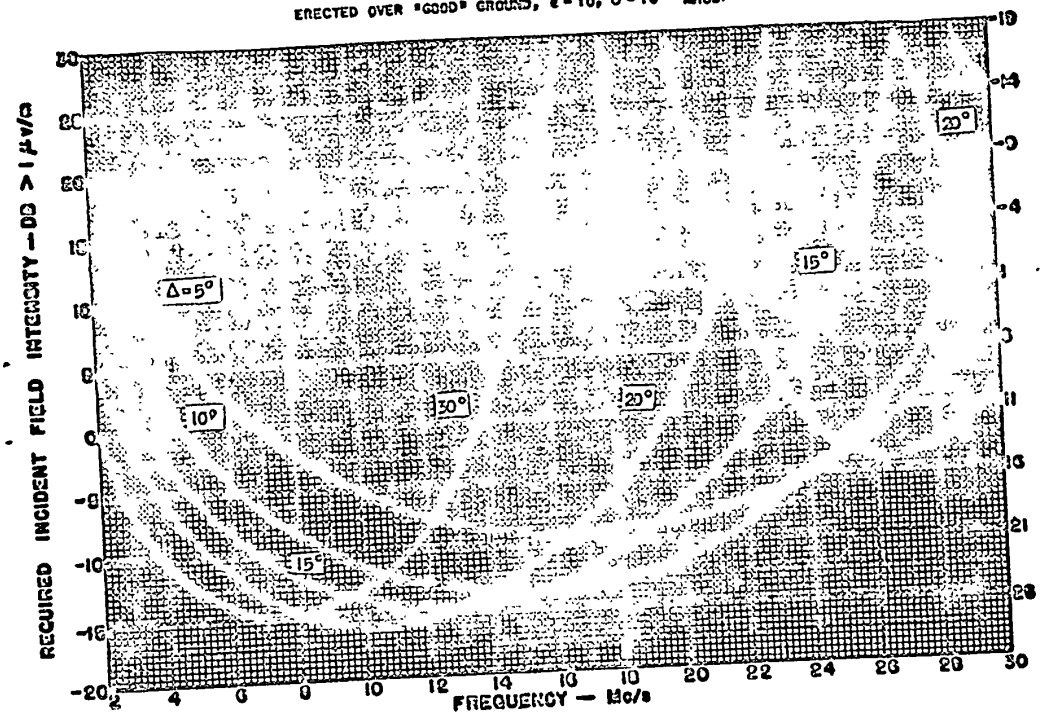

Figure 53

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "F"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

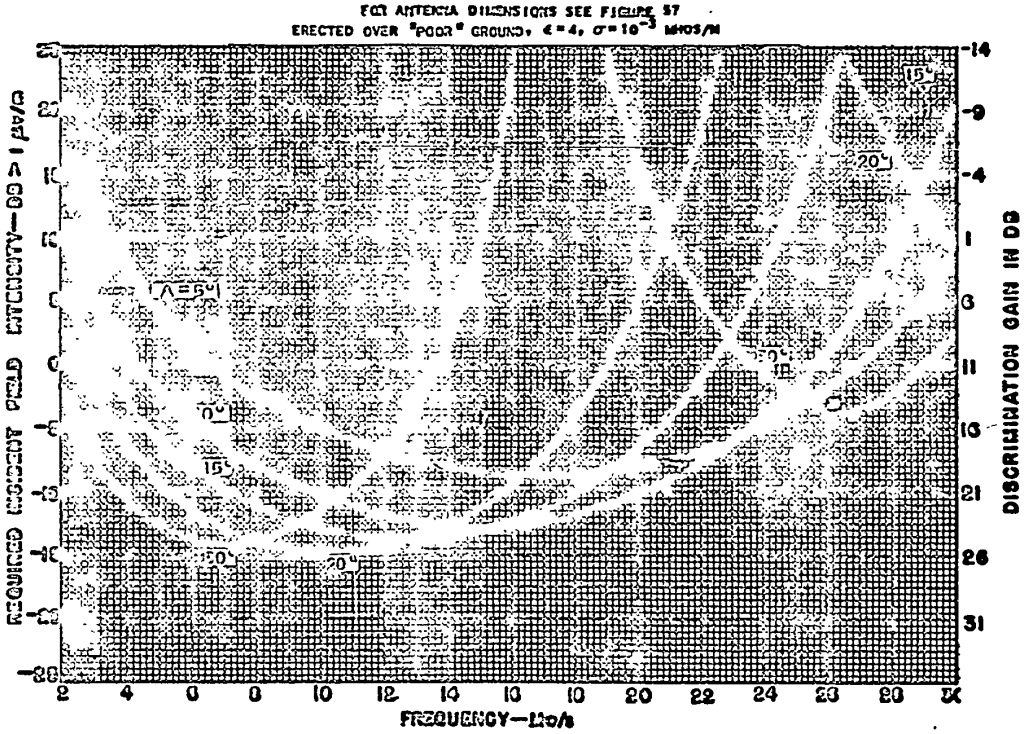

Figure 54

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "G"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57

ERECTED OVER "GOOD" GROUND, $\epsilon = 10$, $\sigma = 10^{-2}$ MHOS/M

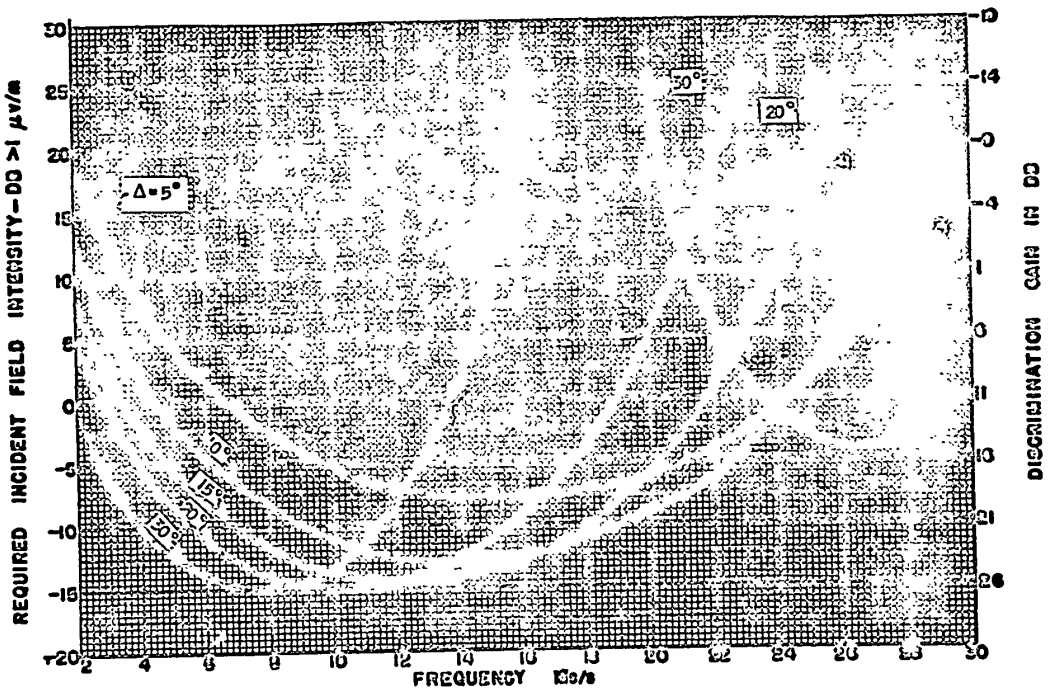

Figure 55

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/01/31 : CIA-RDP81-01043R002900240004-6

MINIMUM REQUIRED INCIDENT FIELD INTENSITIES
(HOURLY MEDIAN VALUES)
TO ASSURE RADIOTELEPHONE COMMUNICATION
FOR NINETY PERCENT OF THE DAYS
IN THE PRESENCE OF SET NOISE ONLY

AND

DISCRIMINATION GAINS WHEN RECEIVING
IN THE PRESENCE OF ATMOSPHERIC NOISE

FOR

HORIZONTAL RHOMBIC ANTENNA TYPE "G"

CURVES ARE FOR VARIOUS VERTICAL ANGLES OF WAVE ARRIVAL
MEASURED FROM THE HORIZONTAL PLANE ALONG THE PRINCIPLE
AXIS OF THE ANTENNA IN THE DIRECTION OF RECEPTION

FOR ANTENNA DIMENSIONS SEE FIGURE 57
ERECTED OVER "POOR" GROUND, $\epsilon = 4$, $\sigma = 10^{-3}$ MHOS/M

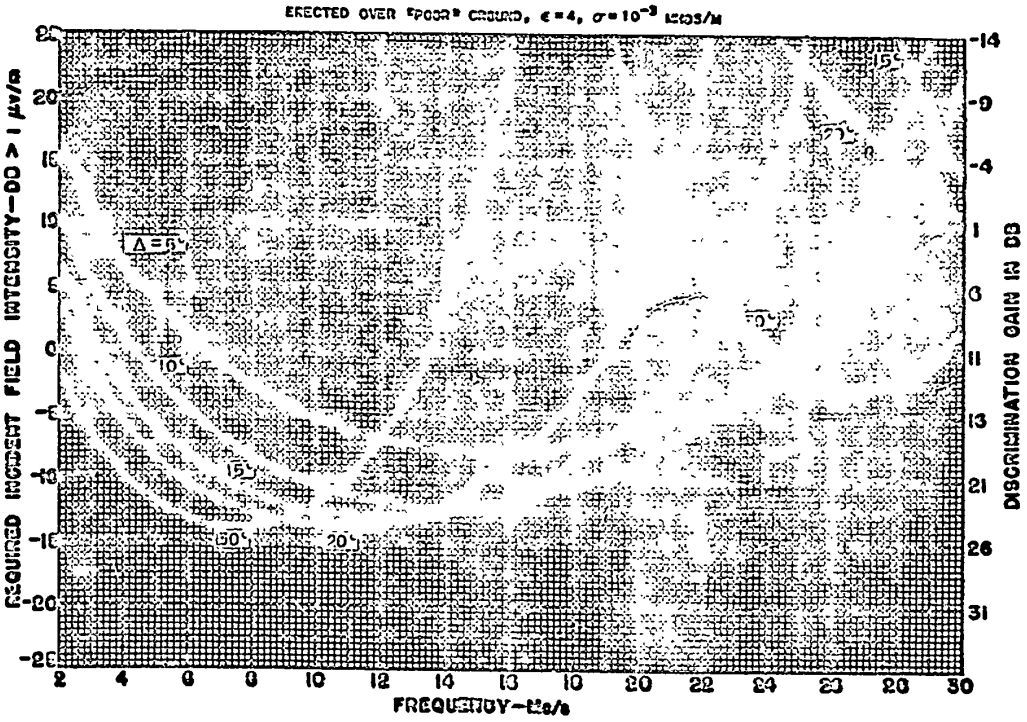

Figure 56

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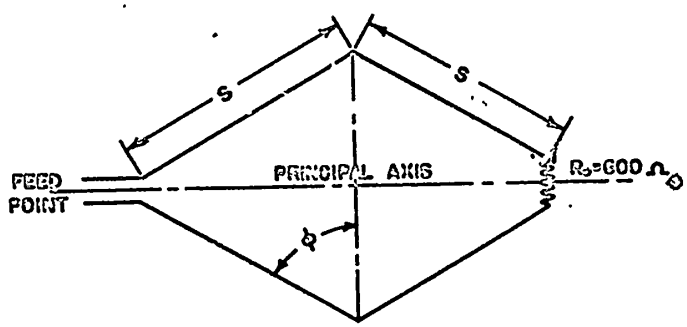
DIMENSIONS OF SIGNAL CORPS RHOMBIC ANTENNAS



ANTENNA TYPE	SIDE S FEET	ANGLE ϕ DEGREES	ANTENNA HEIGHT FEET
A	375	70	65
B	350	70	60
C	315	70	57
D	290	67.5	55
E	270	65	53
F	245	62.5	51
G	225	60	50

Figure 57

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REQUIRED INCIDENT FIELD INTENSITY FOR A HALF-WAVE DIPOLE
IN THE PRESENCE OF COSMIC NOISE
FOR DOUBLE SIDEBAND RADIOTELEPHONY

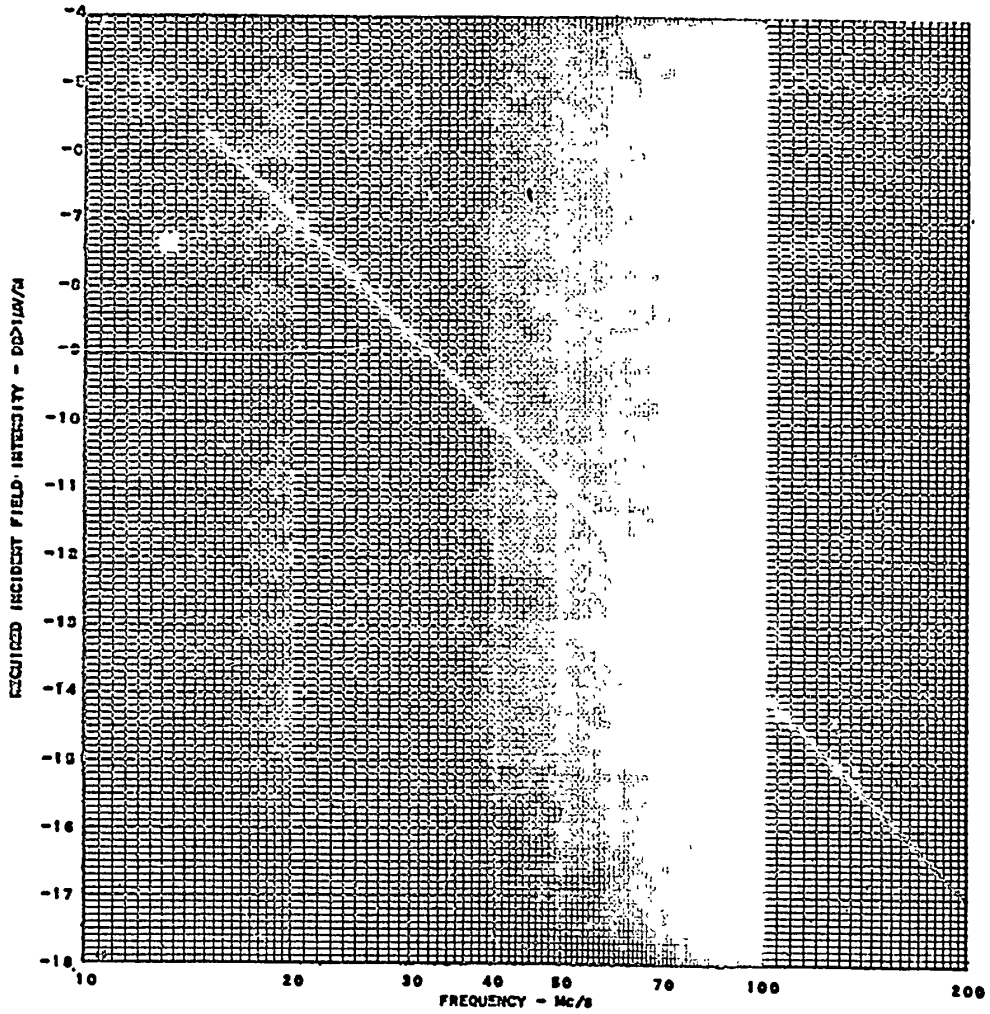

Figure 58

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RADIATION ANGLE VS GREAT CIRCLE DISTANCE

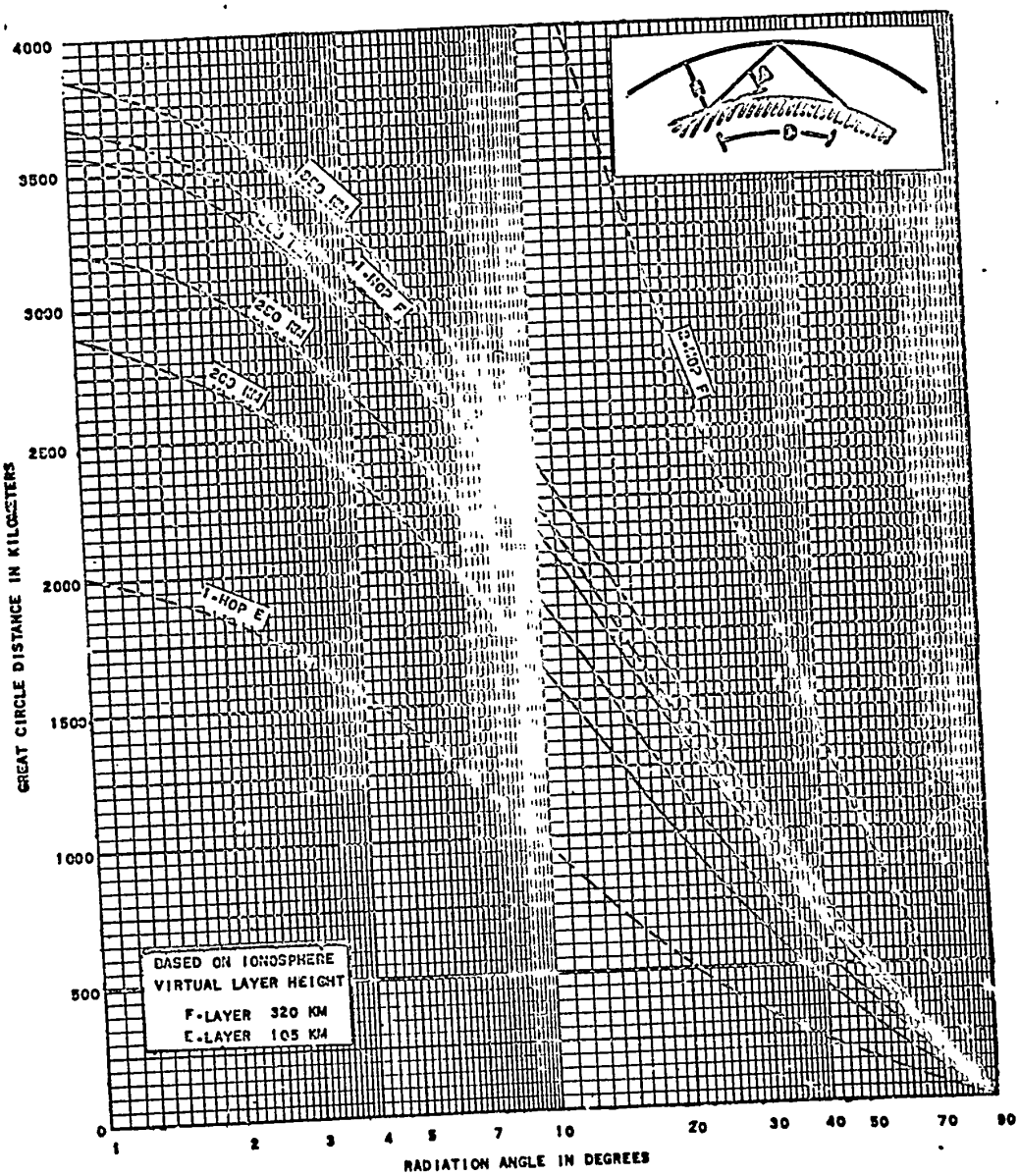

Figure 59

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