3. FREQUENCY VARIATION AND DATA ON NOISE VARIABILITY

In the last section we presented the updated contour maps of 1 MHz F_{am} expected values along with these maps in numerical form. In this section we present the variation with frequency of F_{am} and the variation of F_a about its median value, F_{am}. Preliminary analysis of the totality of data from the network of recording stations (Figure 3) indicated that no significant change would result for the variation of F_{am} with frequency from that currently given by CCIR Report 322. Similar findings hold for D_u, D_ℓ, σ_{D_u}, σ_{D_ℓ}, and V_{dm}. Figures 58-81, therefore, are the Figures 2b and 2c through 25b and 25c of CCIR Report 322. These are repeated here for completeness, but mainly, we want to give the numerical forms of these statistics. The numerical forms for some of the parameters were not available previously.

The frequency variation of F_{am} was obtained by a least squares mapping of the data by the function

$$F_{am}(x,z) = A_1(z) + A_2(z)x^2 + A_3(z)x^3 + \ldots + A_7(z)x^6, \tag{23}$$

where

$$A_i(z) = B_{i,1} + B_{i,2}z \ , \ i = 1,7.$$

z = the 1 MHz F_{am} value (from the contour maps), and

$$x = \frac{8 \times 2^{\log_{10}f} - 11}{4} \ , \tag{24}$$

where f is the desired frequency in MHz.

The mapping was subject to the constraint $F_{am}(-0.75,z) = z$ (i.e., the 1 MHz value must equal z). From the above, 14 coefficients represent each of the 24 frequency variations (each season and 4-hour time period). Note that the frequency variation (as well as D_u, etc.) is a function of _season_, whereas the contour maps are given for _3-month periods_. For example, December, January, and February are _Winter_ in the Northern Hemisphere and _Summer_ in the Southern Hemisphere. Tables 31-34 give coefficients for each season/4-hour time period and the program FREQL demonstrates how the coefficients are used to produce the frequency variation curves. Table 35 gives the output of FREQL. The example shown gives F_{am} values for 27 frequencies and 9 1-MHz F_{am} values (20-100 dB). That is, this example "covers" CCIR Report 322 Figure 2b (Figure 58, here). For any particular 1 MHz F_{am} value and frequency, program FREQL is easily modified.
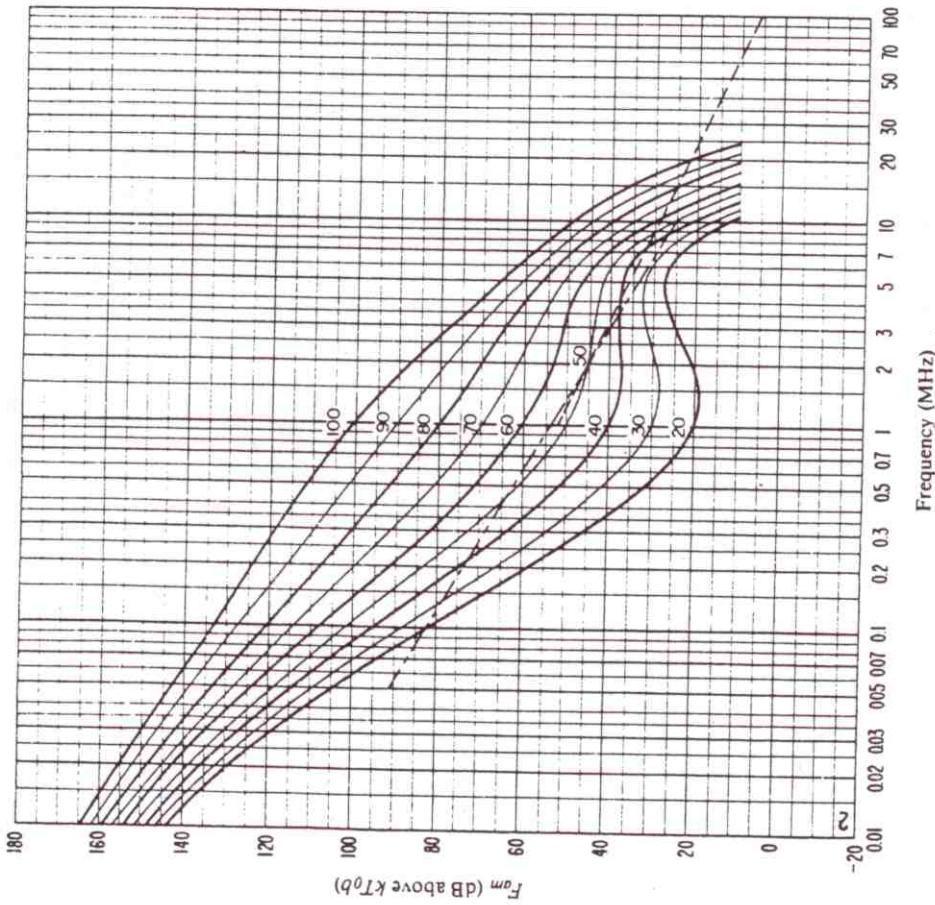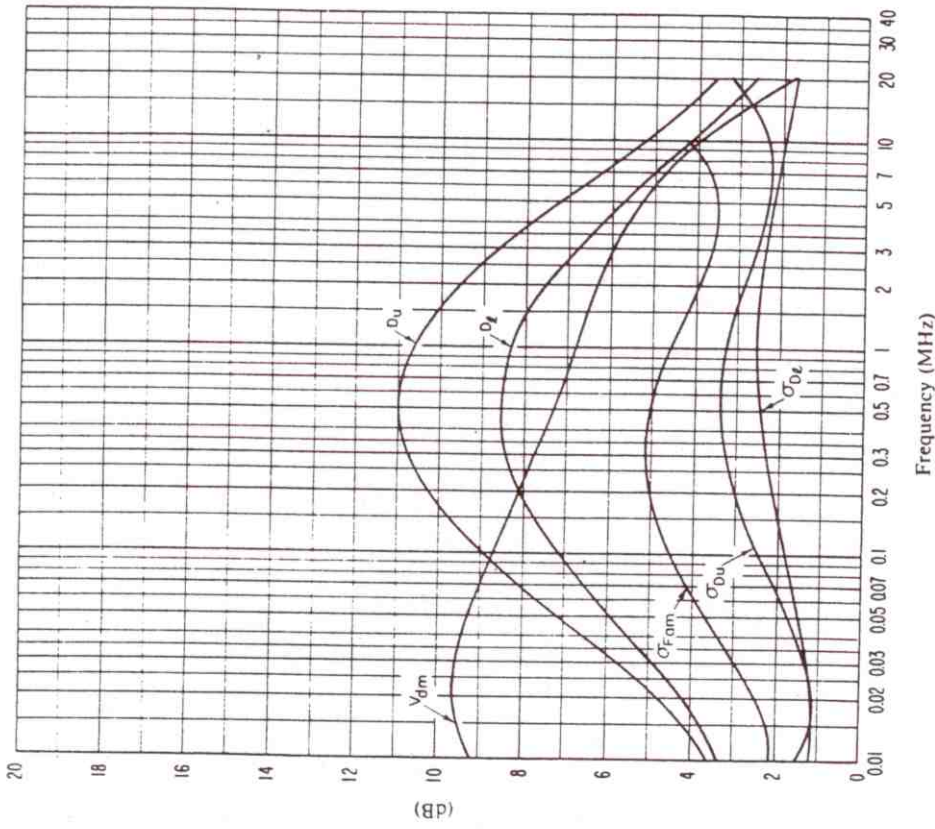
FIGURE 2c – *Data on noise variability and character*
(*Winter; 0000-0400 h*)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
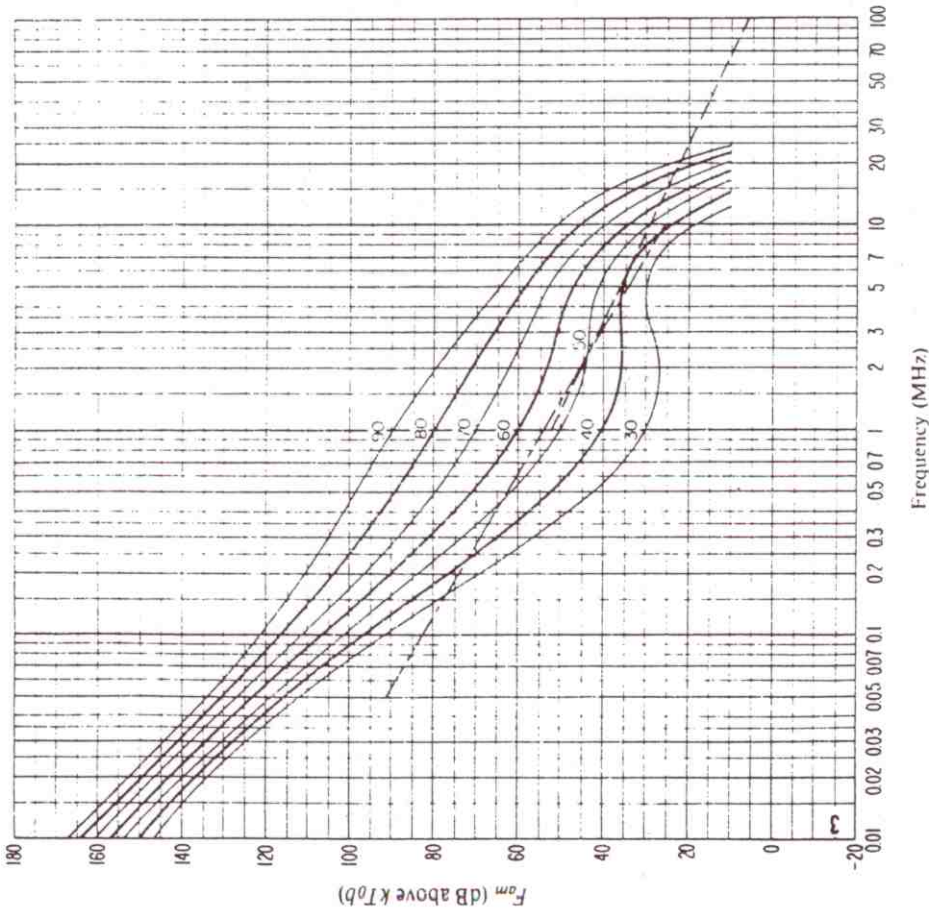The values shown are for a bandwidth of 200 Hz.

FIGURE 2b – *Variation of radio noise with frequency*
(*Winter; 0000-0400 h*)

——— Expected values of atmospheric noise

—·—·— Expected values of man-made noise at a quiet receiving location

— — — Expected values of galactic noise

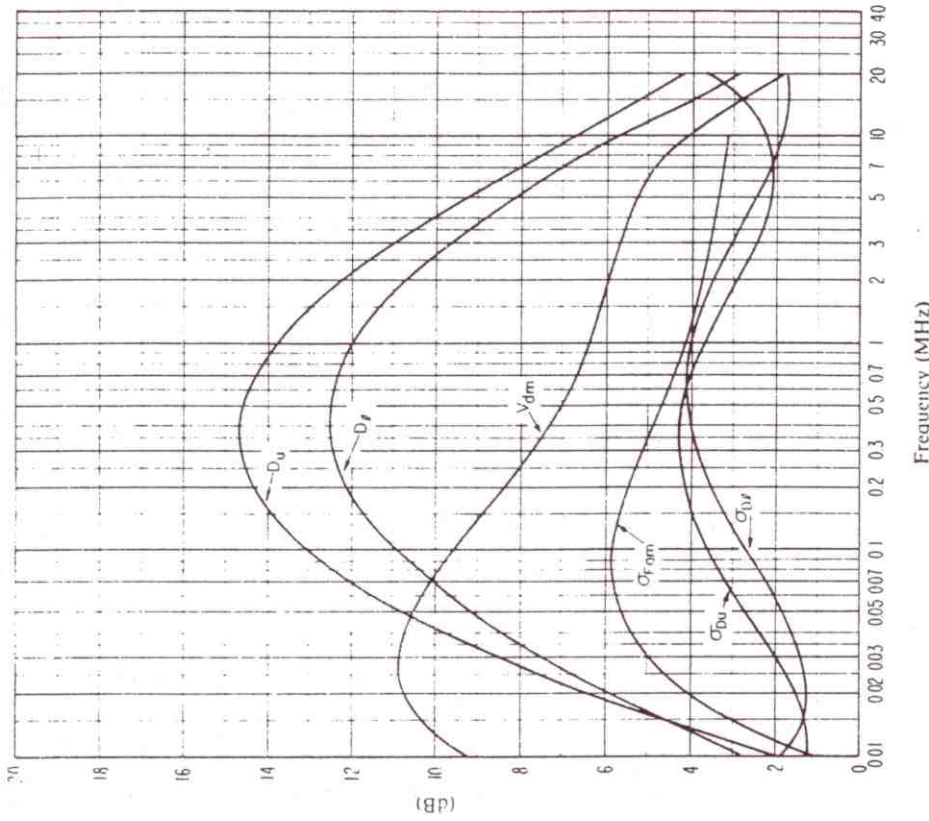Figure 58.   Figures 2b and 2c from CCIR Report 322.

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FIGURE 3c – *Data on noise variability and character*
(Winter; 0400-0800 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
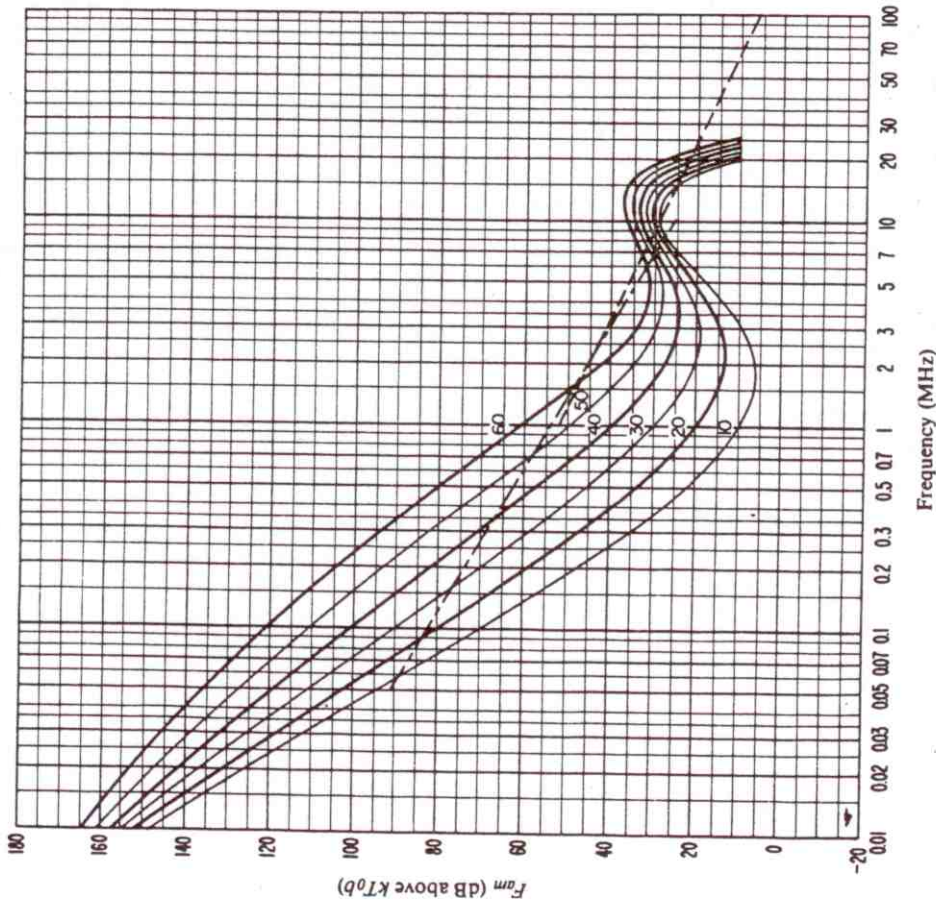The values shown are for a bandwidth of 200 Hz.

FIGURE 3b – *Variation of radio noise with frequency*
(Winter; 0400-0800 h)

——— Expected values of atmospheric noise

— · — · Expected values of man-made noise at a quiet
receiving location

— — — Expected values of galactic noise

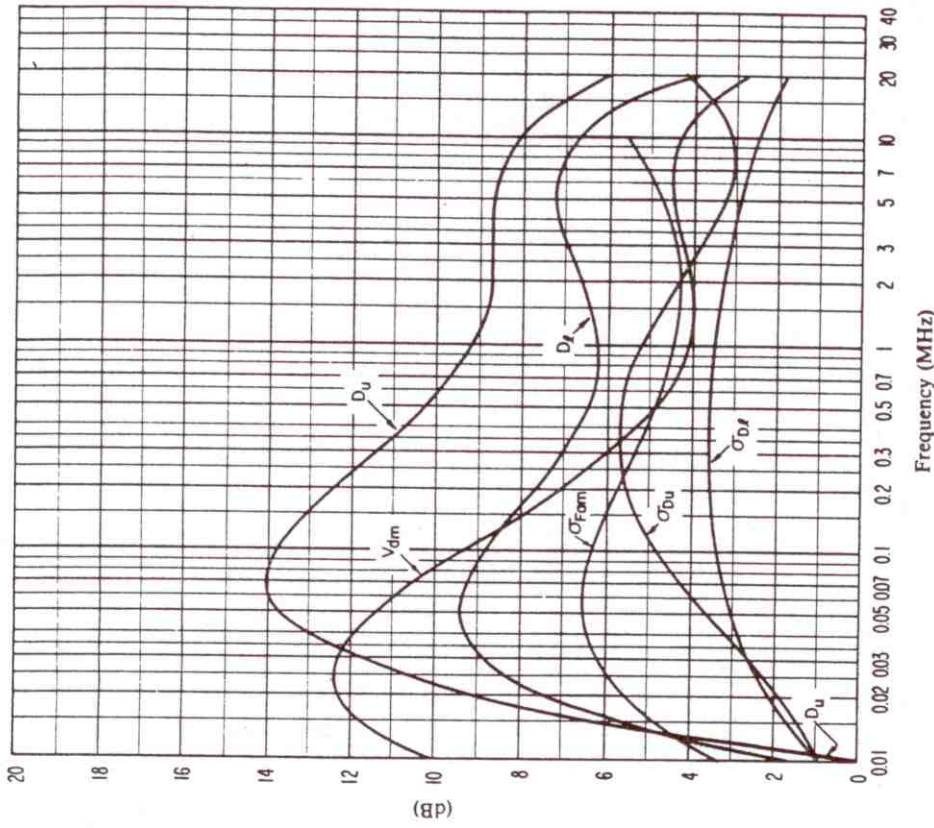Figure 59.   Figures 3b and 3c from CCIR Report 322.

FIGURE 4c – *Data on noise variability and character*
(Winter; 0800-1200 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
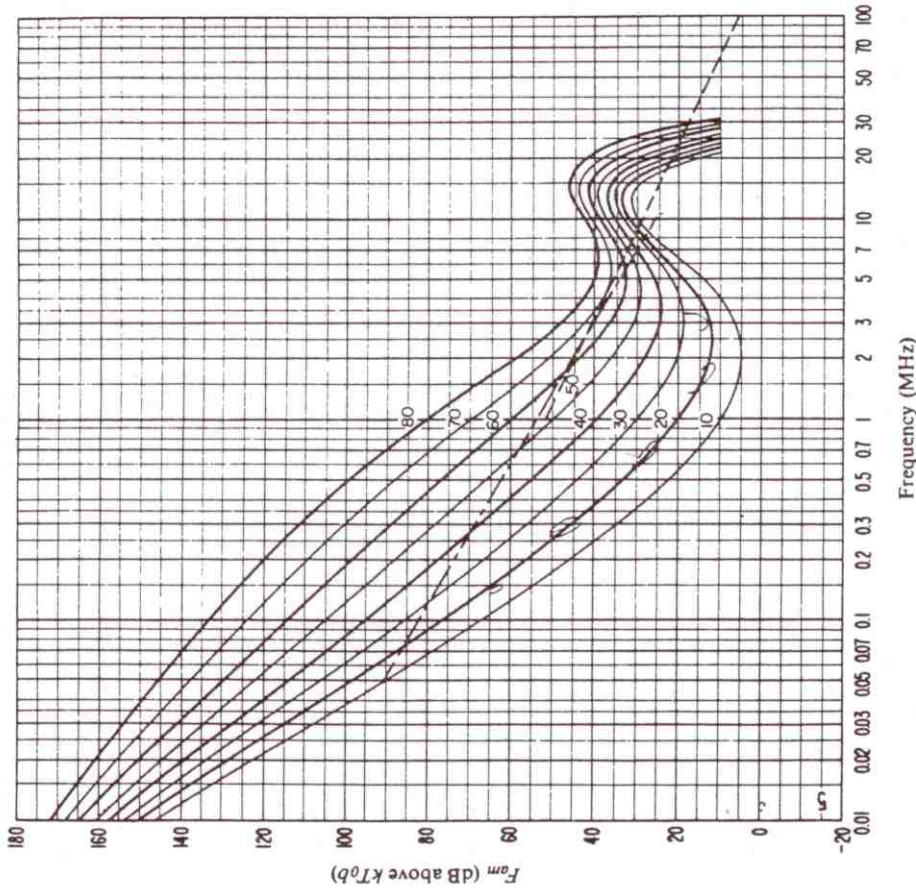The values shown are for a bandwidth of 200 Hz.

FIGURE 4b – *Variation of radio noise with frequency*
(Winter; 0800-1200 h)

——————— Expected values of atmospheric noise

—··—··— Expected values of man-made noise at a quiet
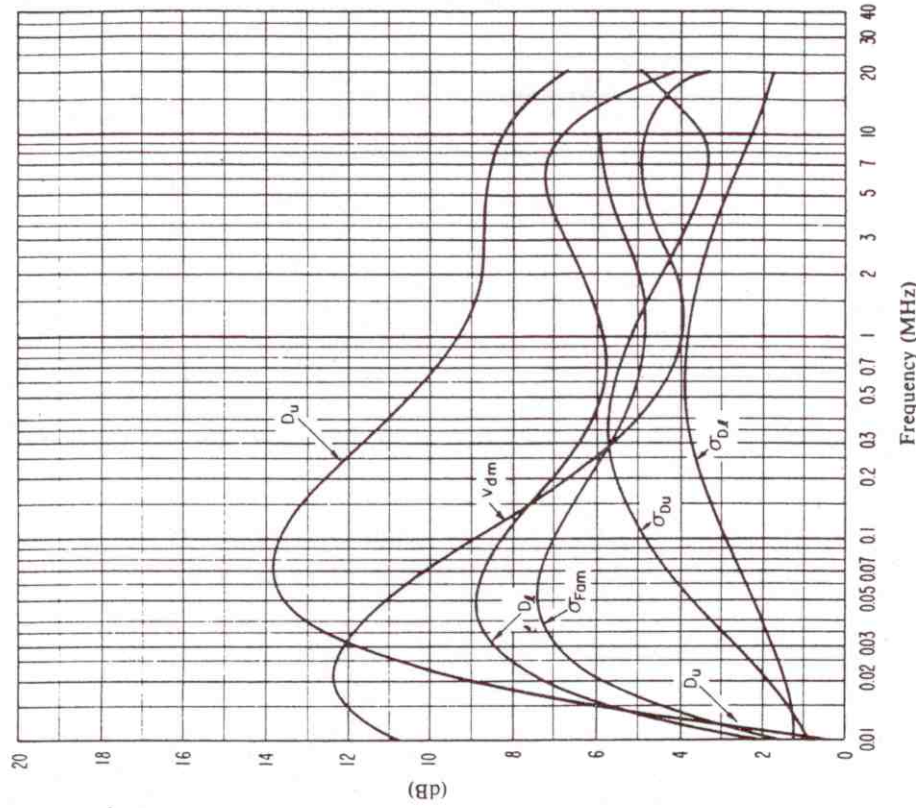receiving location

————— Expected values of galactic noise

Figure 60.   Figures 4b and 4c from CCIR Report 322.

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FIGURE 5c – Data on noise variability and character
(Winter; 1200-1600 h)

$\sigma_{F_{am}}$: Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{D_u} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{D_l} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
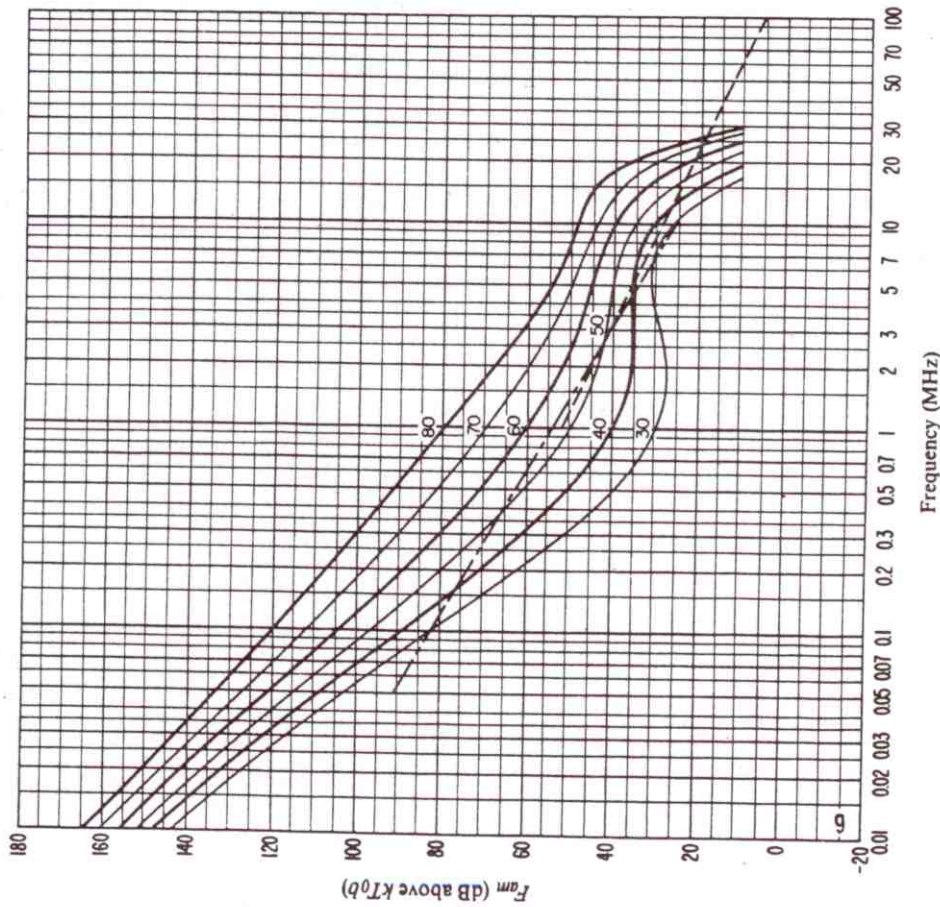The values shown are for a bandwidth of 200 Hz.

FIGURE 5b – Variation of radio noise with frequency
(Winter; 1200-1600 h)

——— Expected values of atmospheric noise
— · — · — Expected values of man-made noise at a quiet
receiving location
— — — Expected values of galactic noise

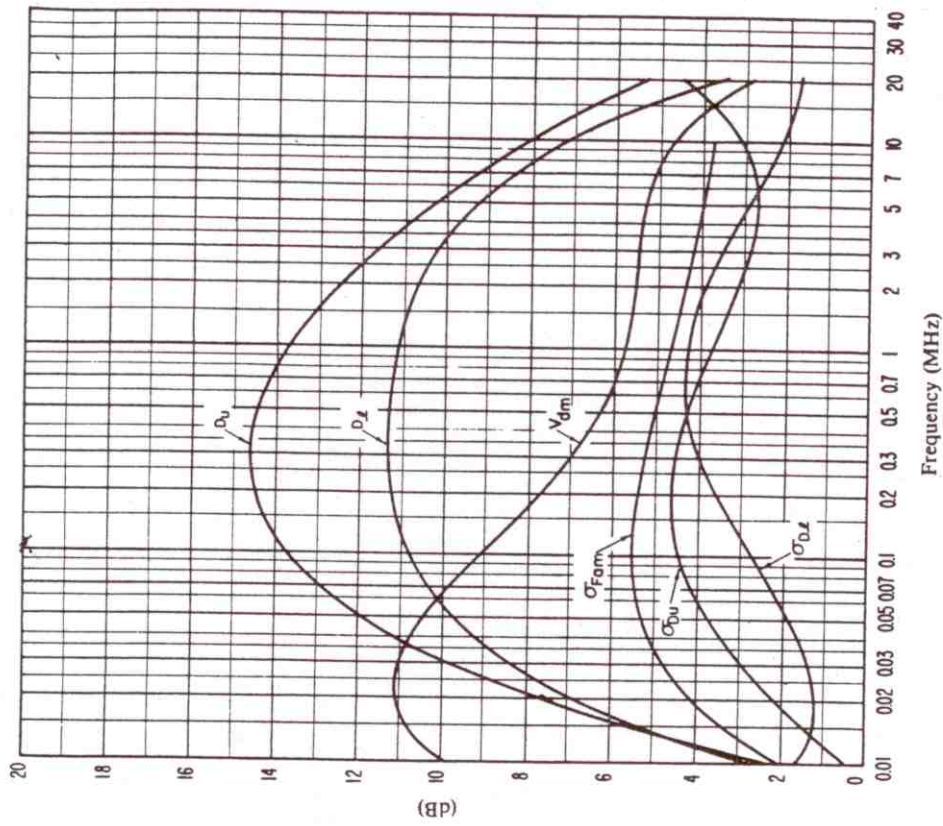Figure 61. Figures 5b and 5c from CCIR Report 322.

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FIGURE 6c – *Data on noise variability and character*
(Winter; 1600-2000 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
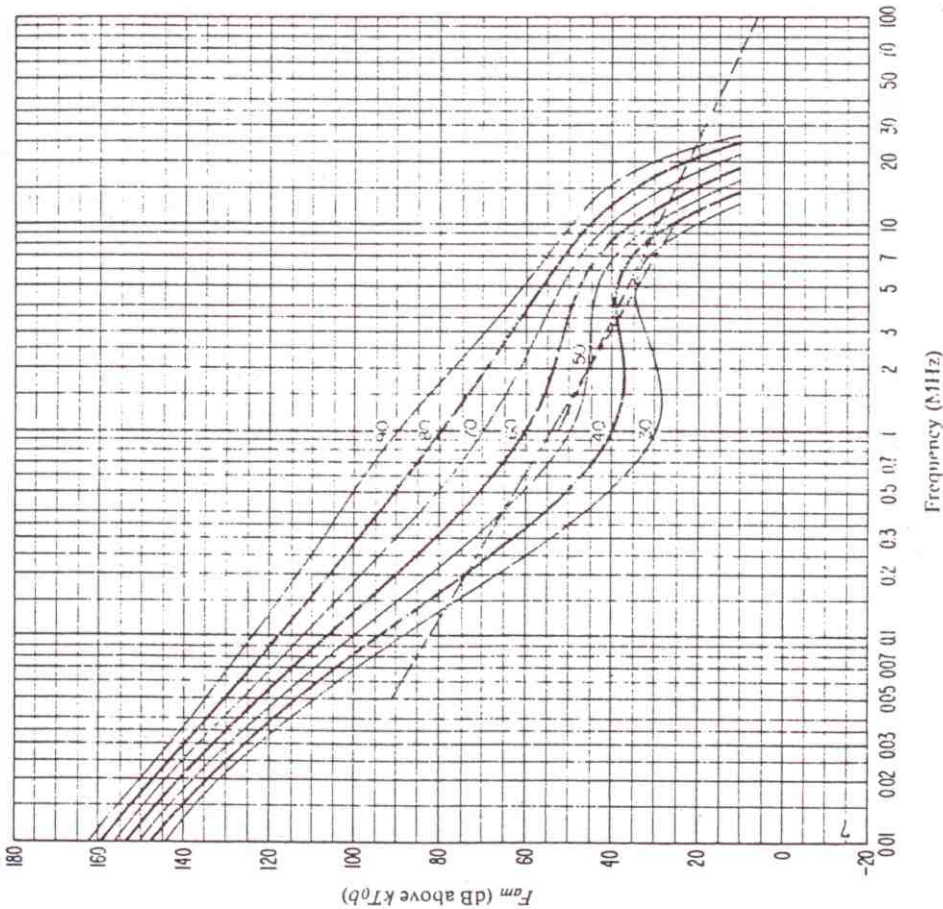The values shown are for a bandwidth of 200 Hz.

FIGURE 6b – *Variation of radio noise with frequency*
(Winter; 1600-2000 h)

—————— Expected values of atmospheric noise

—·—·—·— Expected values of man-made noise at a quiet
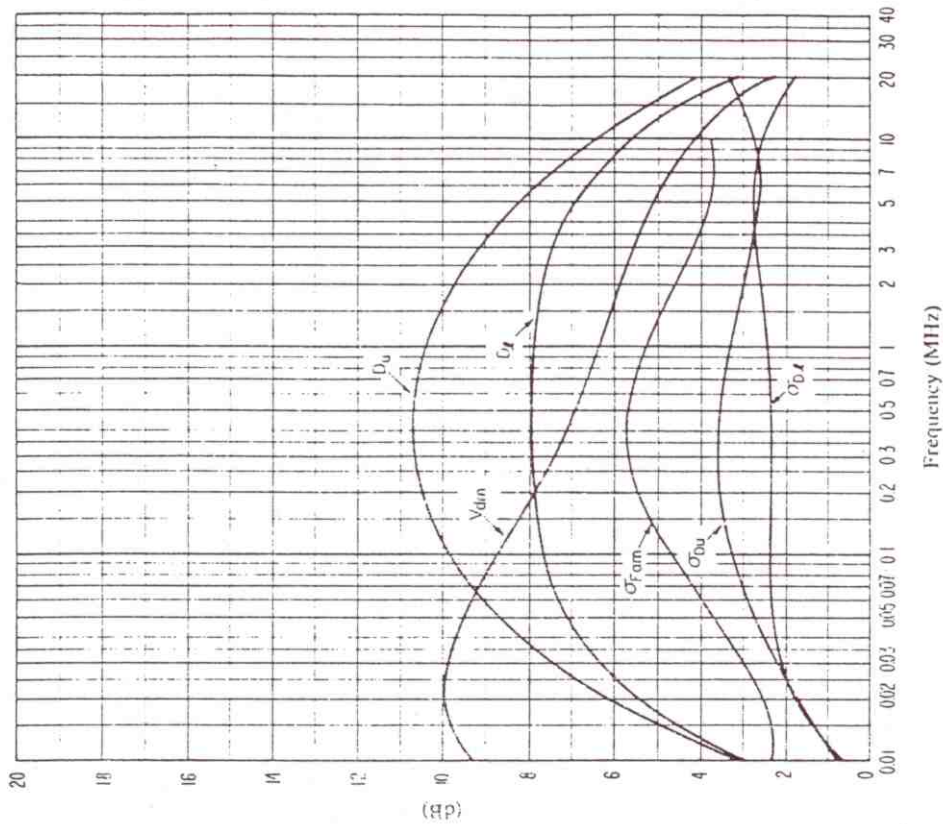receiving location

— — — — Expected values of galactic noise

Figure 62.   Figures 6b and 6c from CCIR Report 322.

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FIGURE 7c – Data on noise variability and character
(Winter; 2000-2400 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
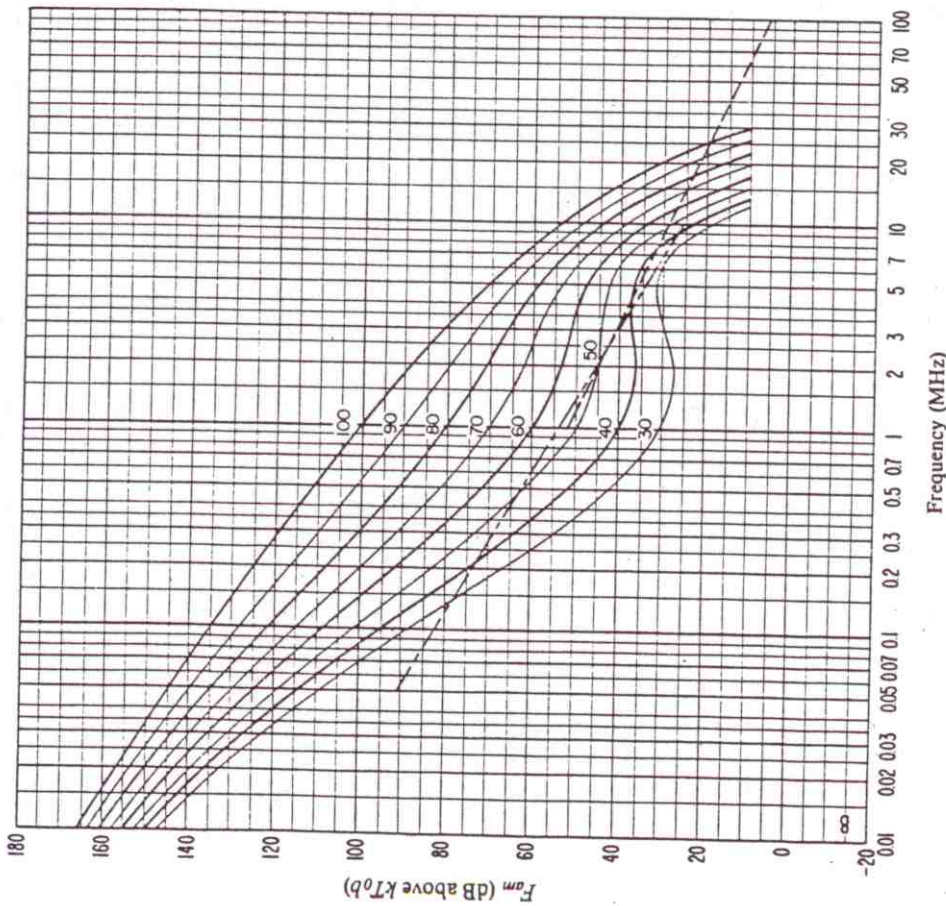The values shown are for a bandwidth of 200 Hz.

FIGURE 7b – Variation of radio noise with frequency
(Winter; 2000-2400 h)

——————— Expected values of atmospheric noise

— · — · — Expected values of man-made noise at a quiet
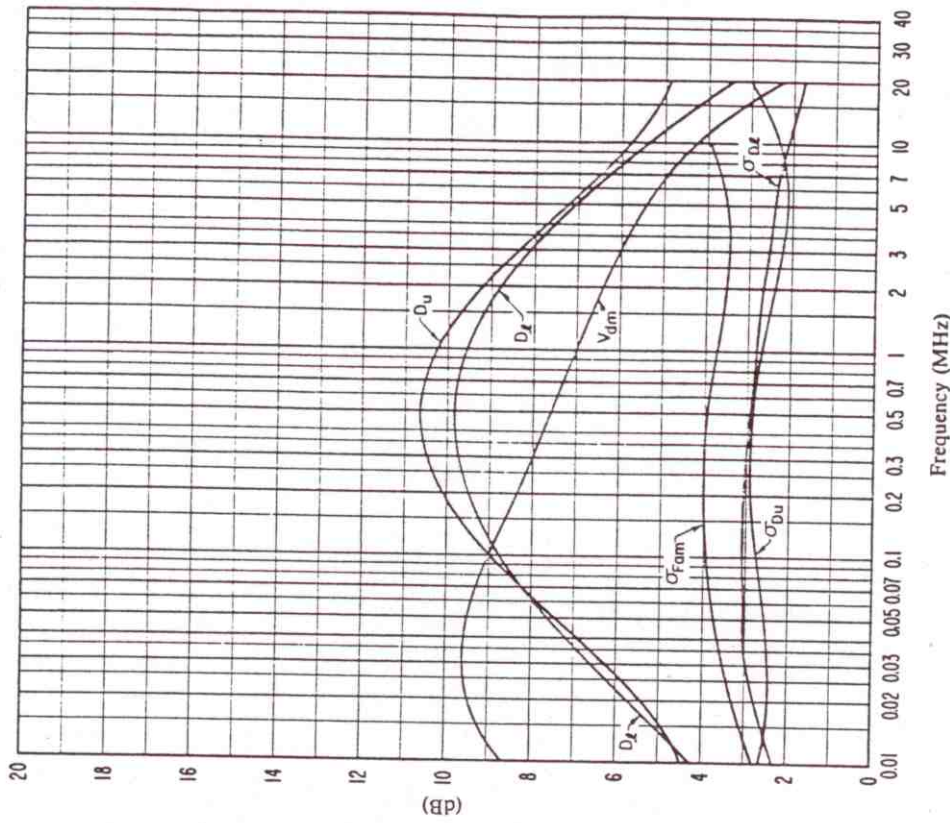receiving location

— — — — Expected values of galactic noise

Figure 63. Figures 7b and 7c from CCIR Report 322.

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FIGURE 8c – *Data on noise variability and character*
(Spring; 0000–0400 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
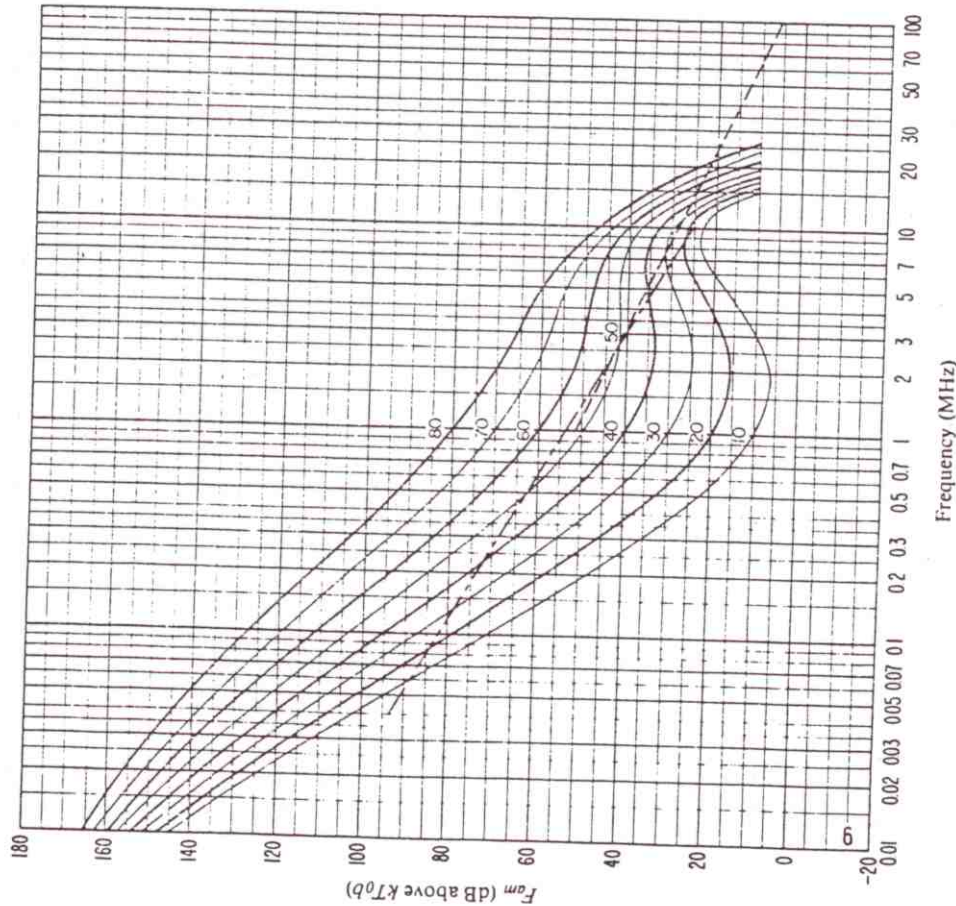The values shown are for a bandwidth of 200 Hz.

FIGURE 8b – *Variation of radio noise with frequency*
(Spring; 0000–0400 h)

——— Expected values of atmospheric noise

— · · — · · — Expected values of man-made noise at a quiet receiving location

— — — Expected values of galactic noise

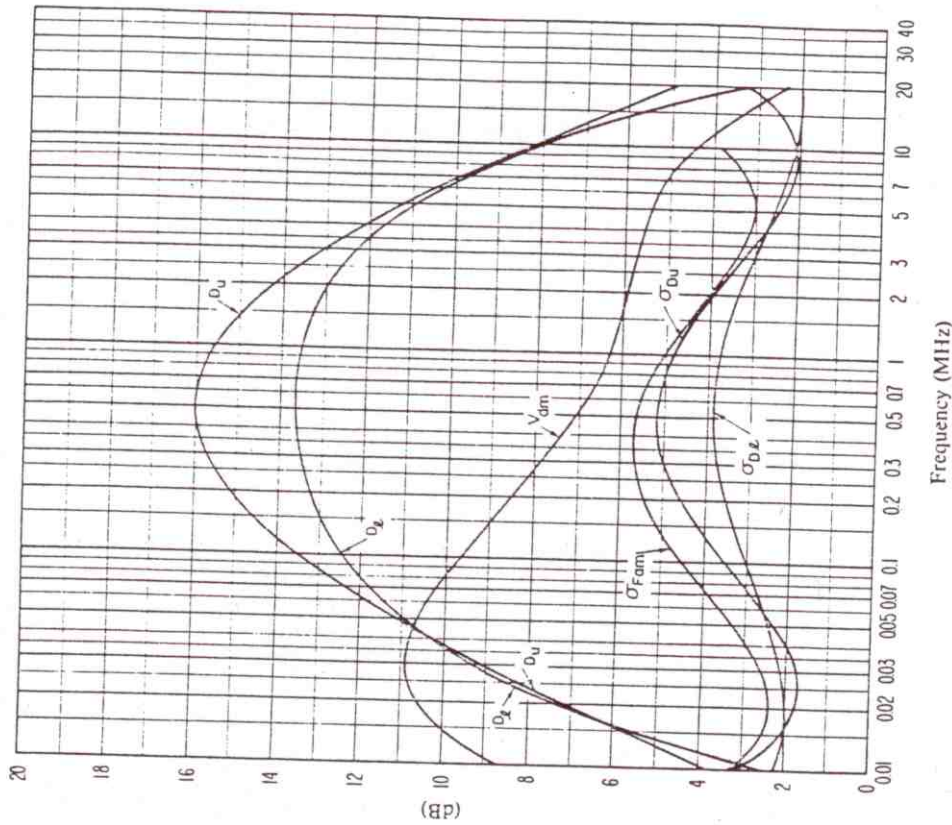Figure 64.   Figures 8b and 8c from CCIR Report 322.

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FIGURE 9c – Data on noise variability and character
(Spring; 0400-0800 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
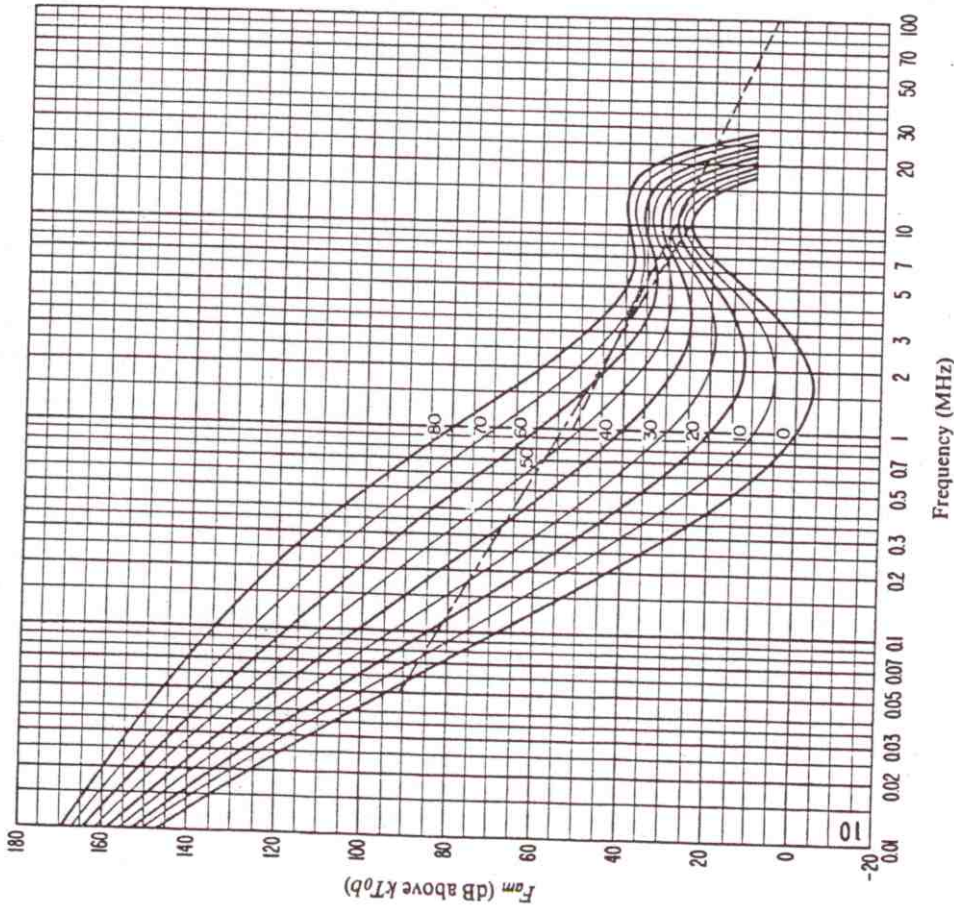The values shown are for a bandwidth of 200 Hz.

FIGURE 9b – Variation of radio noise with frequency
(Spring; 0400-0800 h)

——— Expected values of atmospheric noise

— · · — · Expected values of man-made noise at a quiet
receiving location

— — — Expected values of galactic noise
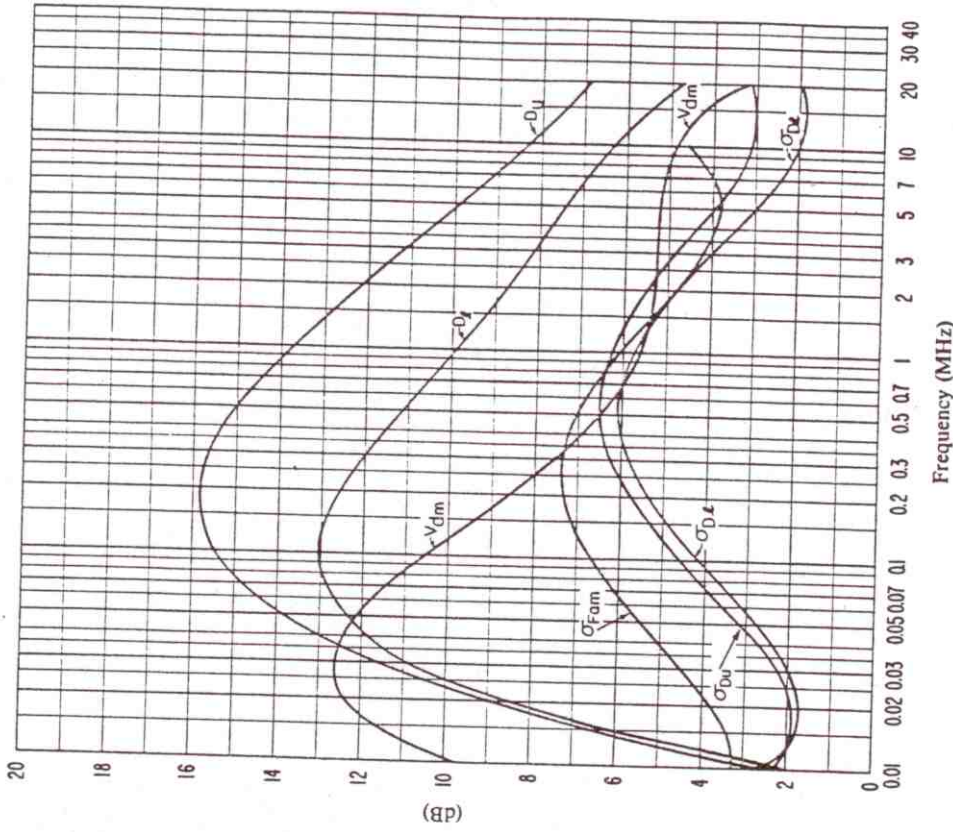
Figure 65.. Figures 9b and 9c from CCIR Report 322.

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FIGURE 10c — Data on noise variability and character
(Spring; 0800-1200 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
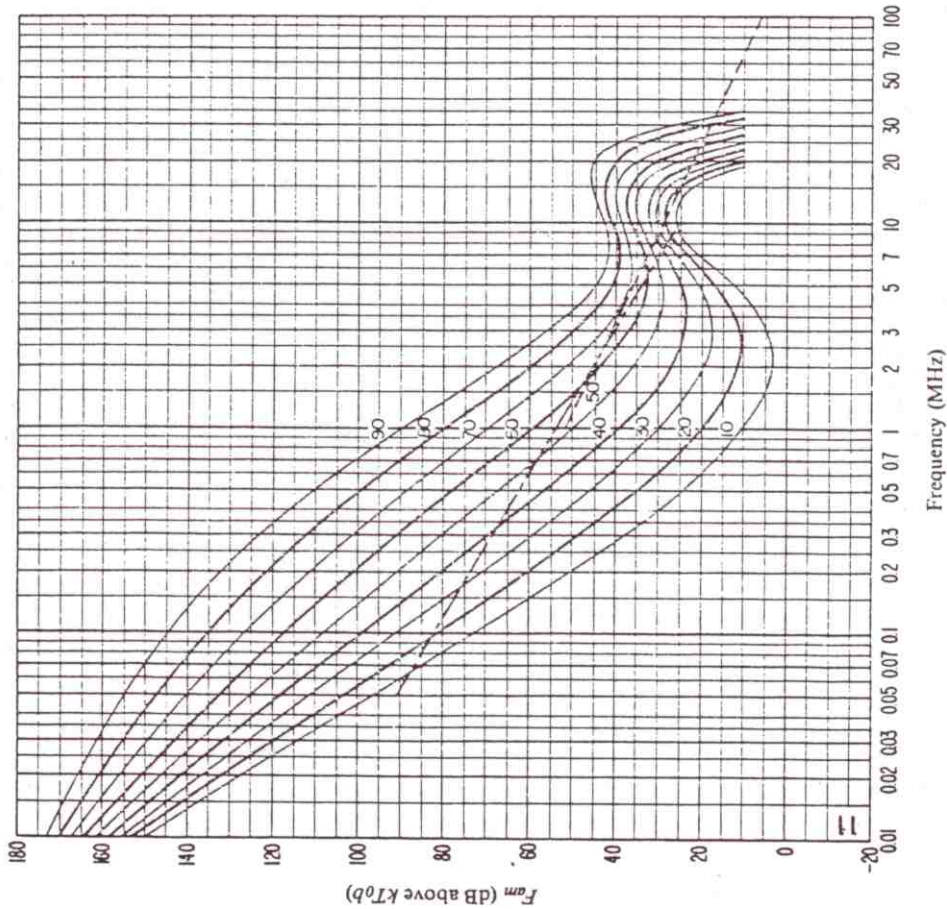The values shown are for a bandwidth of 200 Hz.

FIGURE 10b — Variation of radio noise with frequency
(Spring; 0800-1200 h)

——— Expected values of atmospheric noise

—··—··— Expected values of man-made noise at a quiet receiving location
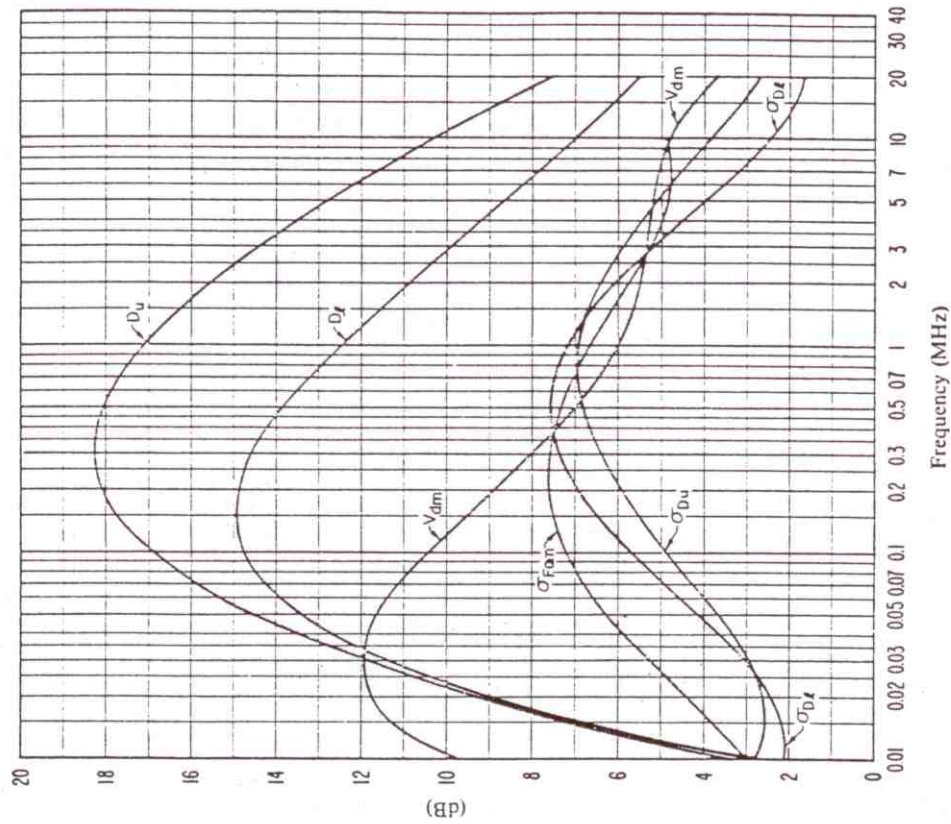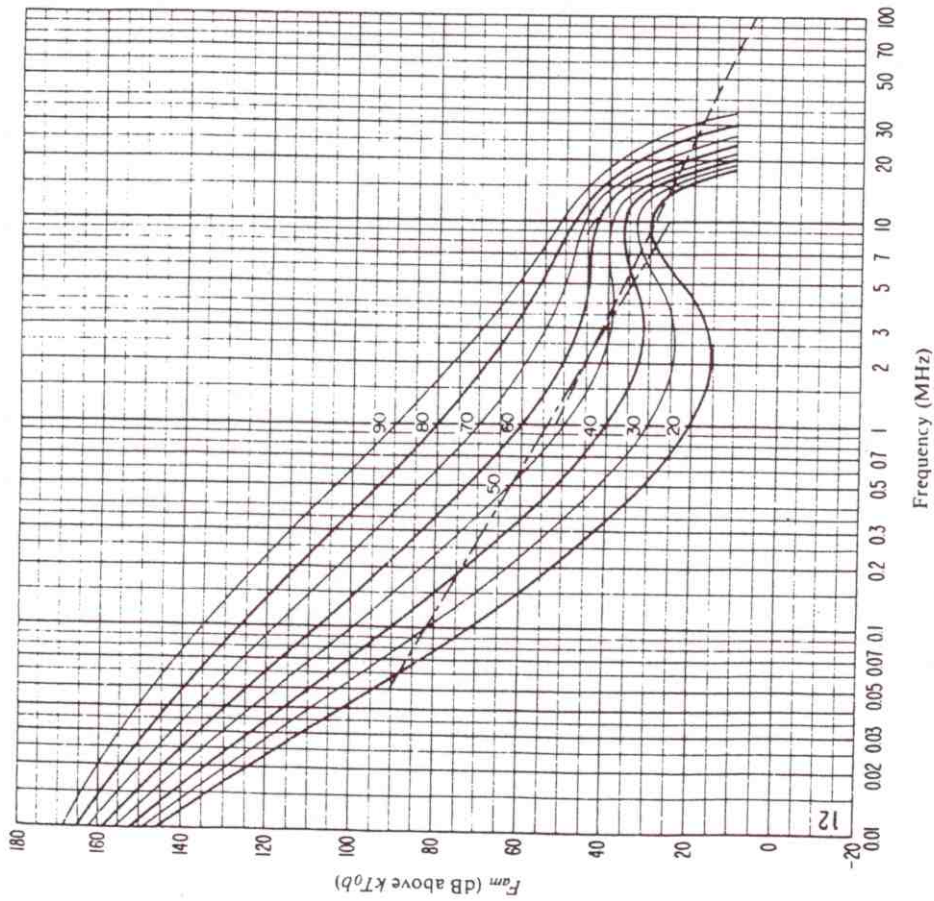
— — — Expected values of galactic noise

Figure 66. Figures 10b and 10c from CCIR Report 322.

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FIGURE 11c — *Data on noise variability and character*
(Spring; 1200-1600 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
The values shown are for a bandwidth of 200 Hz.

FIGURE 11b — *Variation of radio noise with frequency*
(Spring; 1200-1600 h)

——————— Expected values of atmospheric noise

— · · — · · — Expected values of man-made noise at a quiet
receiving location

— — — — Expected values of galactic noise

Figure 67. Figures 11b and 11c from CCIR Report 322.

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FIGURE 12c – *Data on noise variability and character*
(Spring: 1600-2000 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
The values shown are for a bandwidth of 200 Hz.

FIGURE 12b – *Variation of radio noise with frequency*
(Spring; 1600-2000 h)

——— Expected values of atmospheric noise

— · — · — Expected values of man-made noise at a quiet
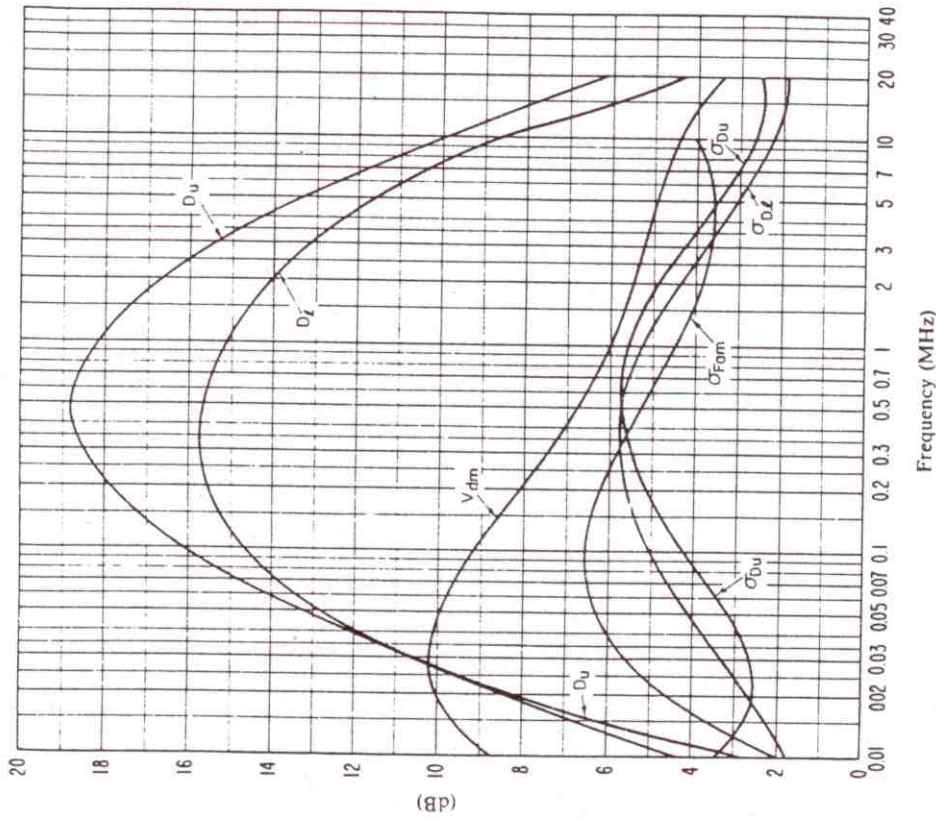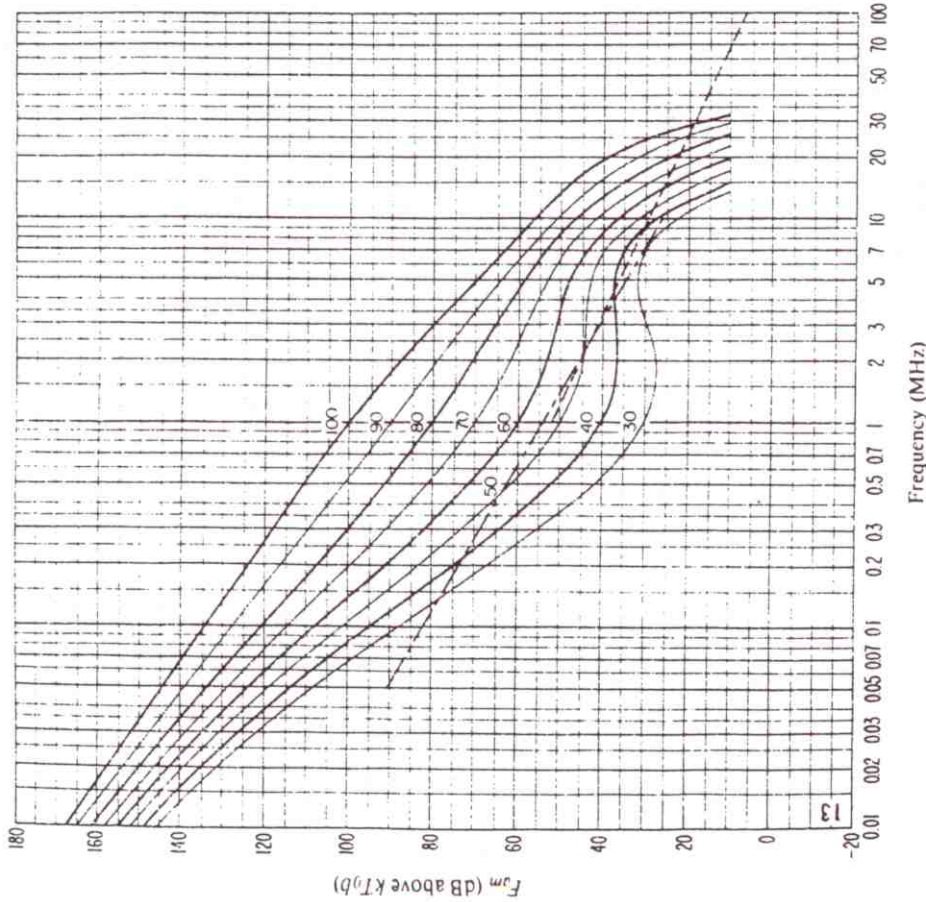receiving location

— — — Expected values of galactic noise

Figure 68. Figures 12b and 12c from CCIR Report 322.

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FIGURE 13c — *Data on noise variability and character*
(Spring; 2000-2400 h)

Frequency (MHz)

(dB)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
The values shown are for a bandwidth of 200 Hz.

FIGURE 13b — *Variation of radio noise with frequency*
(Spring; 2000-2400 h)

Frequency (MHz)

F_{am} (dB above kT_0b)

—————— Expected values of atmospheric noise

— · — · — Expected values of man-made noise at a quiet receiving location
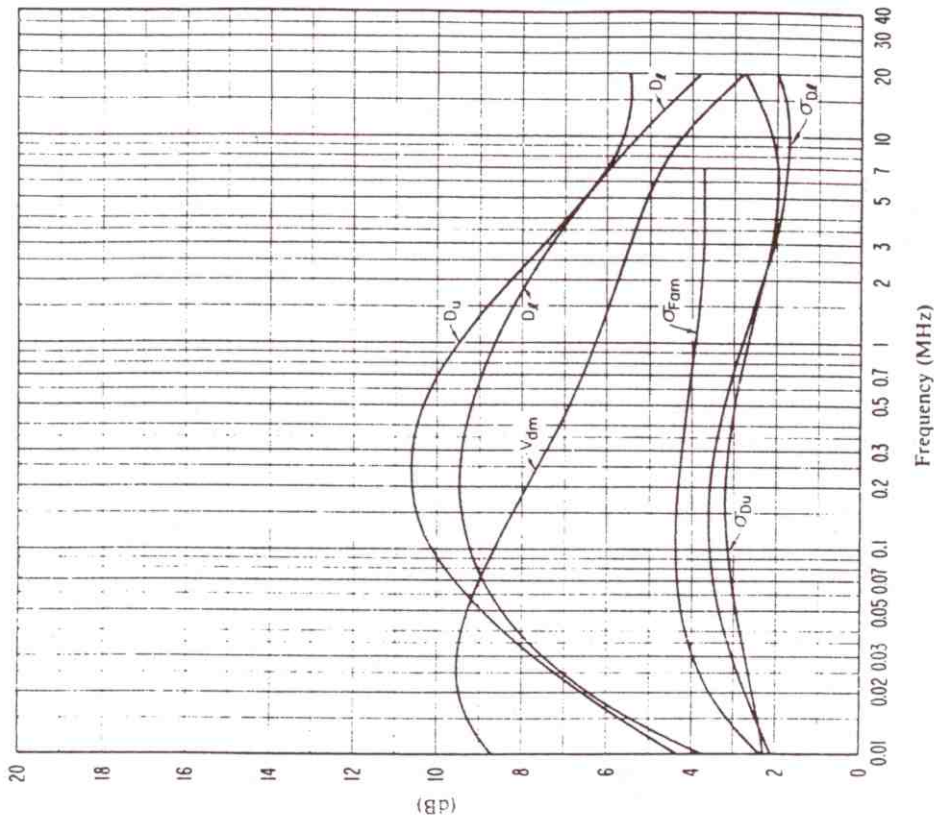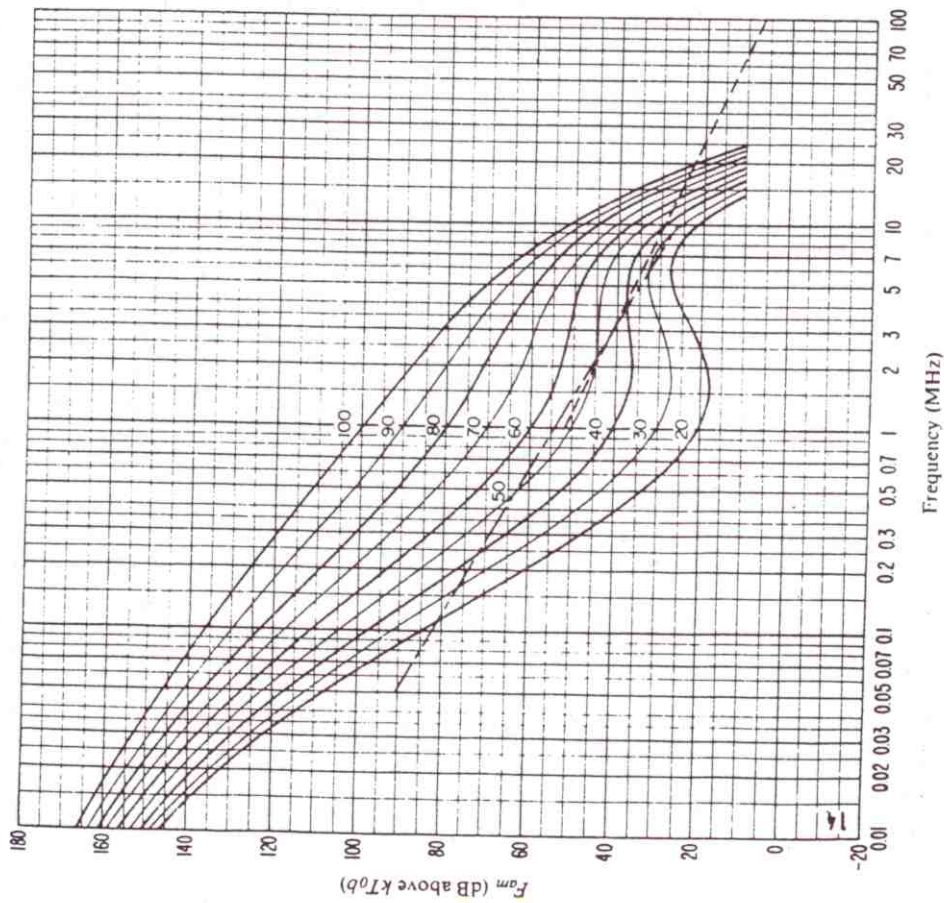
— — — — Expected values of galactic noise

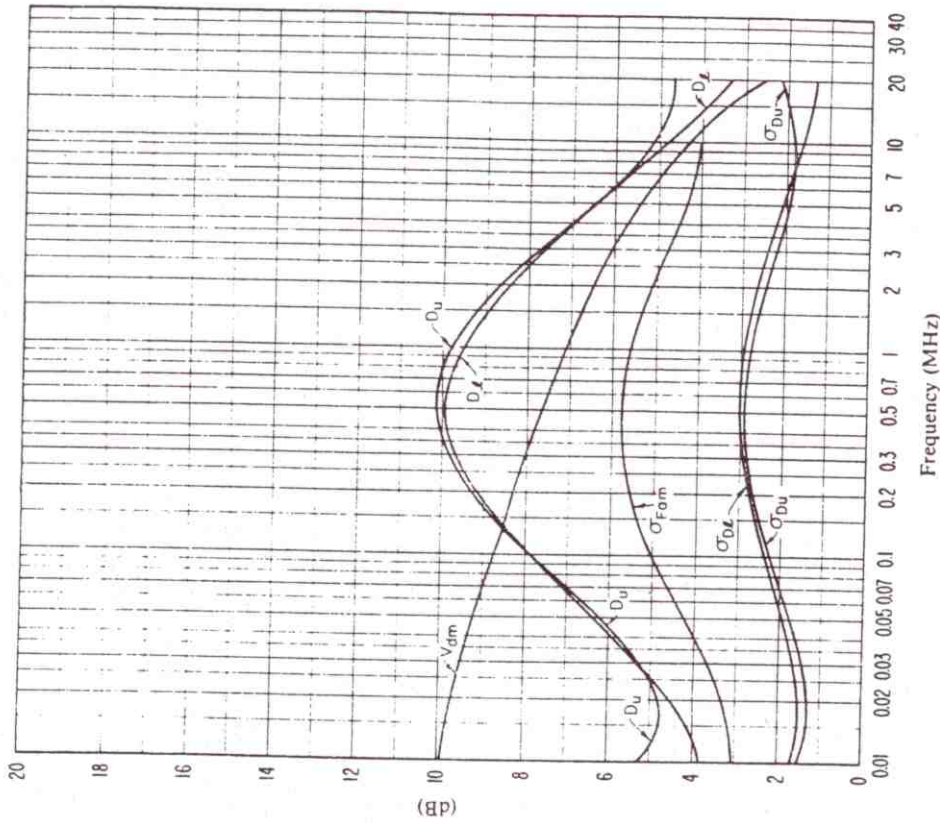**Figure 69.** Figures 13b and 13c from CCIR Report 322.

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FIGURE 14c – Data on noise variability and character
(Summer; 0000-0400 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
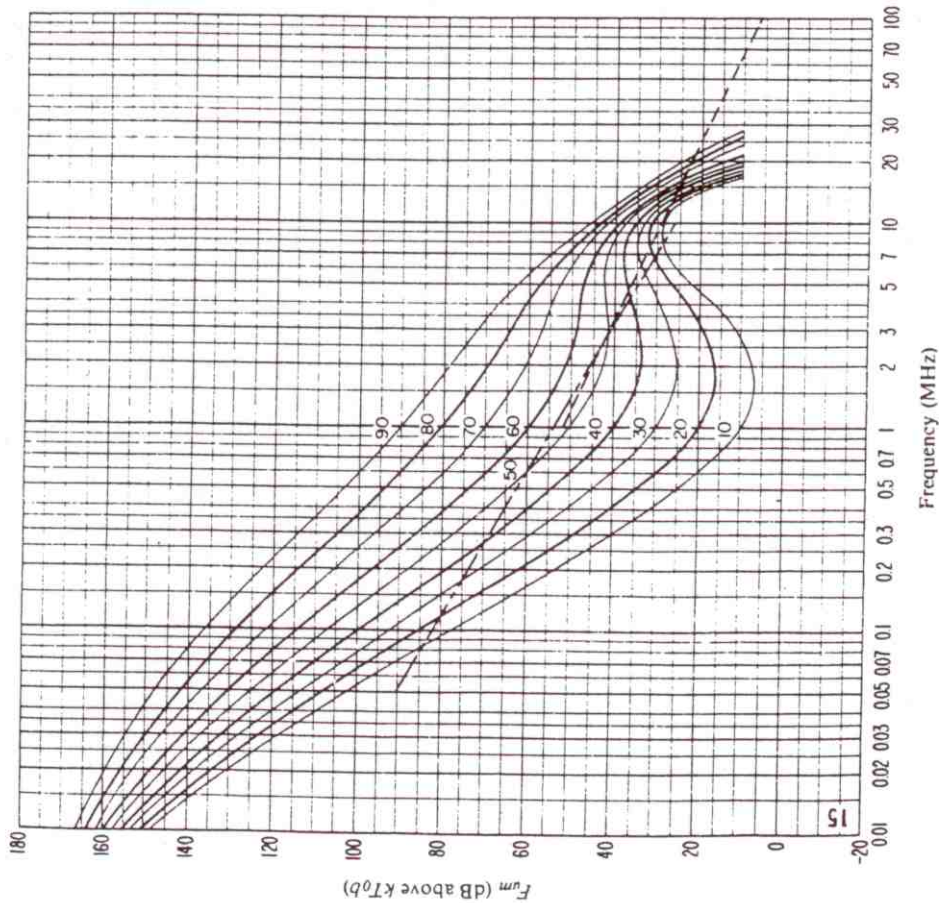The values shown are for a bandwidth of 200 Hz.

FIGURE 14b – Variation of radio noise with frequency
(Summer; 0000-0400 h)

——— Expected values of atmospheric noise

—··—··— Expected values of man-made noise at a quiet
receiving location

——— Expected values of galactic noise

Figure 70. Figures 14b and 14c from CCIR Report 322.

FIGURE 15c – *Data on noise variability and character*
(Summer; 0400-0800 h)

σ_{Fam} : Standard deviation of values of F_{am}
D_u : Ratio of upper decile to median value, F_{am}
σ_{Du} : Standard deviation of values of D_u
D_l : Ratio of median value, F_{am}, to lower decile
σ_{Dl} : Standard deviation of value of D_l
V_{dm} : Expected value of median deviation of average voltage.
The values shown are for a bandwidth of 200 Hz.

FIGURE 15b – *Variation of radio noise with frequency*
(Summer; 0400-0800 h)

——— Expected values of atmospheric noise

—··—··— Expected values of man-made noise at a quiet receiving location
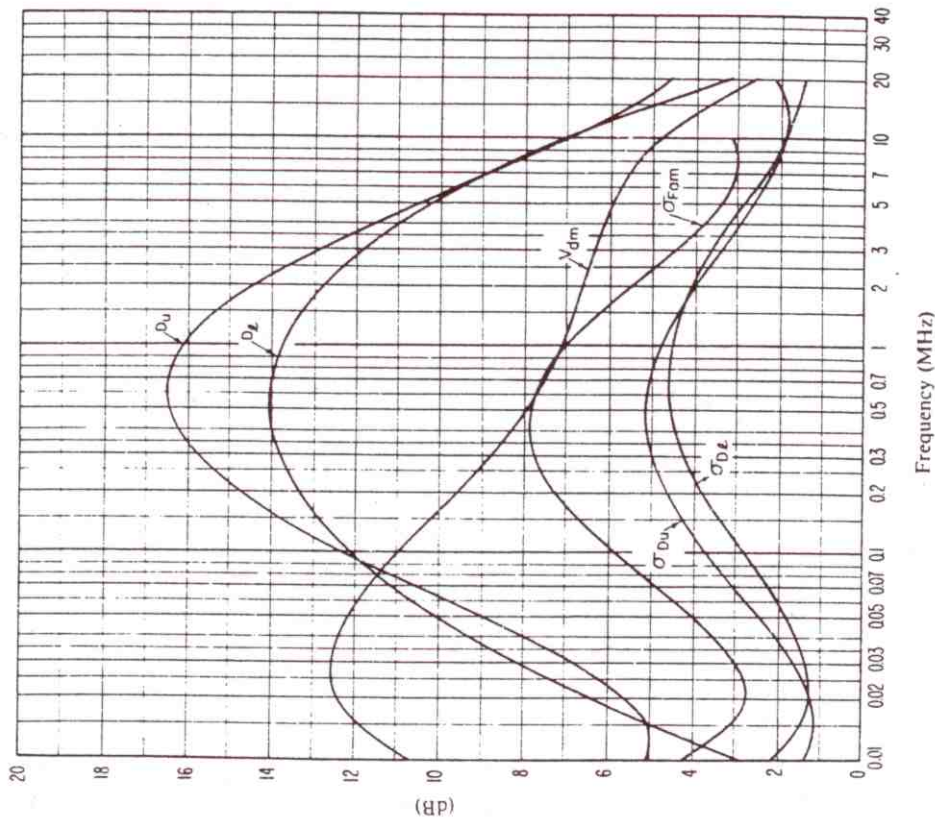
——— Expected values of galactic noise

Figure 71. Figures 15b and 15c from CCIR Report 322.

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