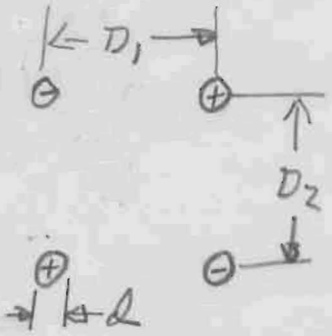
Reference Data for Radio Engineers p 590 15/6/65



for $d \ll D_1$ or D_2

$$Z = 138 \log_{10} \frac{2D_2}{d\sqrt{1+(D_2/D_1)^2}}$$

When $D_2 = D_1 = D$

$$Z = 138 \log_{10} \sqrt{2}\,\frac{D}{d}$$

let $D = 2\frac{1}{2}$ and $d = 0{,}080$

$\sqrt{2}\,\frac{2.5}{.080} = 44.2 \quad \log_{10} 44.2 = 1{,}646$

$Z = 227$ ohms.

Probable $DB = 4{,}343 \frac{\sqrt{F}}{dZ}$ per 1000 ft.

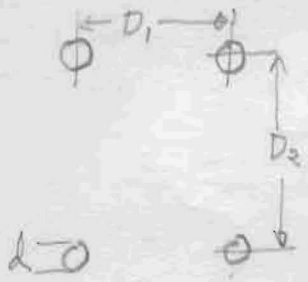
Let $F = 5{,}5$ mc

$DB = 4.343 \frac{\sqrt{5{,}5}}{.08 \cdot 227} = 0.561$ per 1000 ft.

By comparison a two wire line of $Z = 600$ and $d = 0.08$

$DB = 8.686 \frac{\sqrt{5.5}}{.08 \cdot 600} = 0.424$ per 1000 ft.

I.T.T. Reference Data for Radio Engineers, 4th edition, page 590.



for $d \ll D_1$ or D_2

$$Z = 138 \log_{10} \frac{2D_2}{d\left[1+(D_2/D_1)^2\right]^{1/2}}$$

Let $d = .080$, $D_1 = 2.5$, $D_2 = 3.25$

$$Z = 138 \log_{10} \frac{2 \cdot 3.25}{.080\left[1+(3.25/2.50)^2\right]^{1/2}} = 138 \log_{10} \frac{81.2}{1.64}$$

$$= 138 \log_{10} 49.5 = 138 \cdot 1.695 = 234 \text{ ohms.}$$

When $D_2 = D_1 = D$

$$Z = 138 \log_{10} \sqrt{2}\,\frac{D}{d} = 138 \log \frac{D}{d} + 21$$

See Terman page 174

Page 174 of Terman gives 4 wire line.

$Z = 138 \left(\log_{10} \frac{2D}{d}\right) - 21$

Let $D = 2.5$, $d = .080$, $2D/d = 625$, $\log 62.5 = 1.796$

$Z = 138 \cdot 1.796 - 21 = 248 - 21 = 227$ ohms.

Same as other formula

Nothing on line attenuation for this configuration,

aircore line delay = 984 feet per microsecond $= 3 \cdot 10^{10}$ cm/second
= speed in free space

Line Attenuation   11 June 65

"Radio Engineers Handbook" Terman, 1943

Non Resonant lines, Page 186, eqn 64

$$\text{Decibels} = 8.686\, \alpha\, l$$

Parallel Wire Copper lines, Page 175, eqn 49

$$\alpha = 0.00362 \frac{\sqrt{F}}{d \log_{10}(2D/d)} \text{ per 1000 feet}$$

F = megacycles
d = diameter of wire inches $Z = 276 \log_{10}(2D/d)$ ohms
D = spacing of wire inches

$$\text{Decibels} = 8.686 \frac{\sqrt{F}}{d\, Z} \text{ per 1000 feet}$$ See Figure 40a

Concentric Copper lines, Page 176, eqn 50a

$$\alpha = 0.00362 \frac{\sqrt{F}\left(1 + \frac{D}{d}\right)}{D \log_{10}\left(\frac{D}{d}\right)} \text{ per 1000 feet}$$

d = diameter of inner conductor inches $Z = 138 \log_{10}\left(\frac{D}{d}\right)$ ohms.
D = diameter of outer conductor inches

Lowest attenuation when $D/d = 3.6$ and $Z = 77$ ohms

$$\alpha = 0.0299 \frac{\sqrt{F}}{D} \text{ per 1000 feet.}$$ eqn 50b

$$\text{Decibels} = 0.260 \frac{\sqrt{F}}{D} \text{ per 1000 feet}$$ See Figure 40b