Worksheet 9.5 page 1

$$\text{Amps}(\text{dBmicroA}) := \left| \begin{array}{l} \text{dBA} \leftarrow \text{dBmicroA} - 120 \\ y \leftarrow \frac{\text{dBA}}{20} \\ A \leftarrow 10^{y} \end{array} \right.$$

$$\text{data} := \begin{pmatrix} 20 & 130 \\ 2000 & 130 \\ 50 \cdot 10^{3} & 50 \\ 500 \cdot 10^{3} & 20 \\ 200 \cdot 10^{6} & 20 \end{pmatrix} \qquad F1 := \text{data}^{\langle 1 \rangle} \qquad \text{dB} := \text{data}^{\langle 2 \rangle}$$

$$i := 1 .. \text{rows}(\text{data}) \qquad \text{Ilimit}_i := \text{Amps}(\text{dB}_i)$$

Figure 9.5.2 first page of worksheet 9.5

DCE02.B see DEF STAN 59-411 part 3 issue 1 page 84

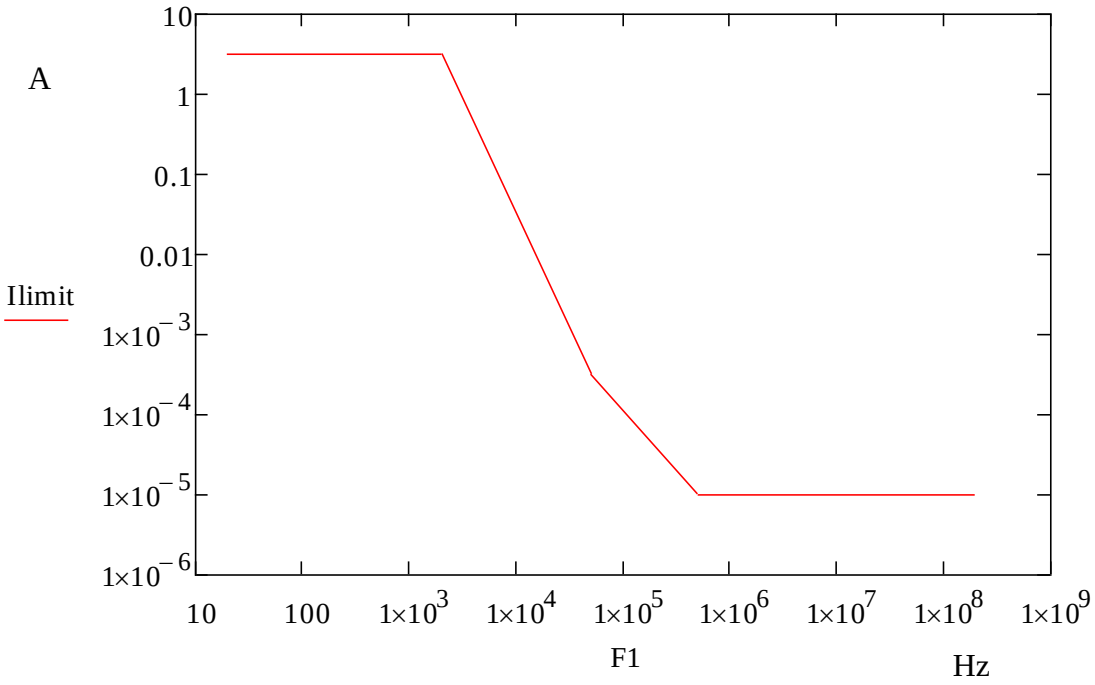

Figure 9.5.1 maximum acceptable emission

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$\mu_o := 4\cdot\pi\cdot 10^{-7}$ $\varepsilon_o := 8.854\cdot 10^{-12}$ $c := 2.998\cdot 10^{8}$ $\rho := 1.7\cdot 10^{-8}$

$h := 10\cdot 10^{-3}$ $s := 1.2\cdot 10^{-3}$ $r := 0.4\cdot 10^{-3}$ $l := 15$ see figure 4.3.1

$Rss_1 := \frac{\rho\cdot l}{\pi\cdot r^2}$ $Rss_2 := Rss_1$ $Rss_3 := 0.005$ equation (2.5.11)

$Fx := \frac{4\cdot\rho}{\mu_o\cdot\pi\cdot r^2}$ $Fx = 1.077\times 10^{5}$ equation (2.5.14)

$Lc_1 := \frac{\mu_o\cdot l}{2\cdot\pi}\cdot\ln\left(\frac{2\cdot h\cdot s}{r\cdot\sqrt{s^2+4\cdot h^2}}\right)$ $Lc_2 := Lc_1$

$Lc_3 := \frac{\mu_o\cdot l}{2\cdot\pi}\cdot\ln\left(\frac{\sqrt{s^2+4\cdot h^2}}{s}\right)$ equation (2.11.3)

$Cc := \frac{1}{Lc}\cdot\left(\frac{l}{c}\right)^2$ equation (2.3.8)

$Fq := \frac{1}{4\cdot\sqrt{Lc_1\cdot Cc_1}}$ $Fq = 4.997\times 10^{6}$ equation (2.3.9)

Component values for three-conductor assembly of figure 5.5.2:-

$\frac{Rss}{2} = \begin{pmatrix} 0.254 \\ 0.254 \\ 2.5\times 10^{-3} \end{pmatrix}$ $\frac{Lc}{2} = \begin{pmatrix} 1.645\times 10^{-6} \\ 1.645\times 10^{-6} \\ 4.223\times 10^{-6} \end{pmatrix}$ $Cc = \begin{pmatrix} 7.608\times 10^{-10} \\ 7.608\times 10^{-10} \\ 2.964\times 10^{-10} \end{pmatrix}$

$Zn := \begin{pmatrix} 132 \\ 0 \\ 0 \end{pmatrix}$ $Zf := \begin{pmatrix} 132 \\ 0 \\ 0 \end{pmatrix}$ $Gc := \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$ $Rrad := 0$

Copied from figure 5.5.3

Worksheet 9.5 page 4

$$\text{Zbranch}(f) := \left| \begin{array}{l} \omega \leftarrow 2\cdot\pi\cdot f \\ \text{for } i \in 1..3 \\ \quad \left| \begin{array}{l} Rc_i \leftarrow Rss_i \cdot \sqrt{1+\frac{f}{Fx}} \\ \theta \leftarrow \sqrt{\left(Rc_i + j\cdot\omega\cdot Lc_i\right)\cdot\left(Gc_i + j\cdot\omega\cdot Cc_i\right)} \\ Zo \leftarrow \sqrt{\frac{Rc_i + j\cdot\omega\cdot Lc_i}{Gc_i + j\cdot\omega\cdot Cc_i}} \\ Z_{1,i} \leftarrow Zo\cdot\tanh\left(\frac{\theta}{2}\right) \\ Z_{2,i} \leftarrow Zo\cdot\operatorname{csch}(\theta) \end{array} \right. \\ Z \end{array} \right.$$

$$\text{Zloop}(f) := \left| \begin{array}{l} Z \leftarrow \text{Zbranch}(f) \\ Z11 \leftarrow Zn_1 + Z_{1,1} + Z_{2,1} + Z_{2,2} + Z_{1,2} + Zn_2 \\ Z12 \leftarrow -\left(Z_{1,2} + Z_{2,2} + Zn_2\right) \\ Z13 \leftarrow -\left(Z_{2,1} + Z_{2,2}\right) \\ Z14 \leftarrow Z_{2,2} \\ Z22 \leftarrow Zn_2 + Z_{1,2} + Z_{2,2} + Z_{2,3} + Z_{1,3} + Zn_3 + Rrad \\ Z23 \leftarrow Z_{2,2} \\ Z24 \leftarrow -\left(Z_{2,2} + Z_{2,3}\right) \\ Z25 \leftarrow -Z_{1,3} \\ Z33 \leftarrow Zf_2 + Z_{1,2} + Z_{2,2} + Z_{2,1} + Z_{1,1} + Zf_1 \\ Z34 \leftarrow -\left(Z_{1,2} + Z_{2,2} + Zf_2\right) \\ Z44 \leftarrow Zf_3 + Z_{1,3} + Z_{2,3} + Z_{2,2} + Z_{1,2} + Zf_2 \\ \begin{pmatrix} Z11 & Z12 & Z13 & Z14 \\ Z12 & Z22 & Z23 & Z24 \\ Z13 & Z23 & Z33 & Z34 \\ Z14 & Z24 & Z34 & Z44 \end{pmatrix} \end{array} \right.$$

$$F2 := \begin{pmatrix} 0.0005 \\ 0.005 \\ 0.01 \\ 0.02 \\ 0.05 \\ 0.1 \\ 0.2 \\ 0.5 \\ 1 \\ 2 \\ 5 \\ 15 \\ 25 \\ 35 \\ 45 \\ 55 \\ 65 \\ 75 \\ 95 \end{pmatrix} \cdot 10^6$$

$s := 1 .. \mathrm{rows}(F2)$

$$Iout_s := \left| \begin{array}{l} f \leftarrow F2_s \\ Z \leftarrow Zloop(f) \\ V \leftarrow \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} \\ I \leftarrow lsolve(Z, V) \\ |I_2| \end{array} \right.$$

$\max(\text{Iout}) = 3.735 \times 10^{-3}$

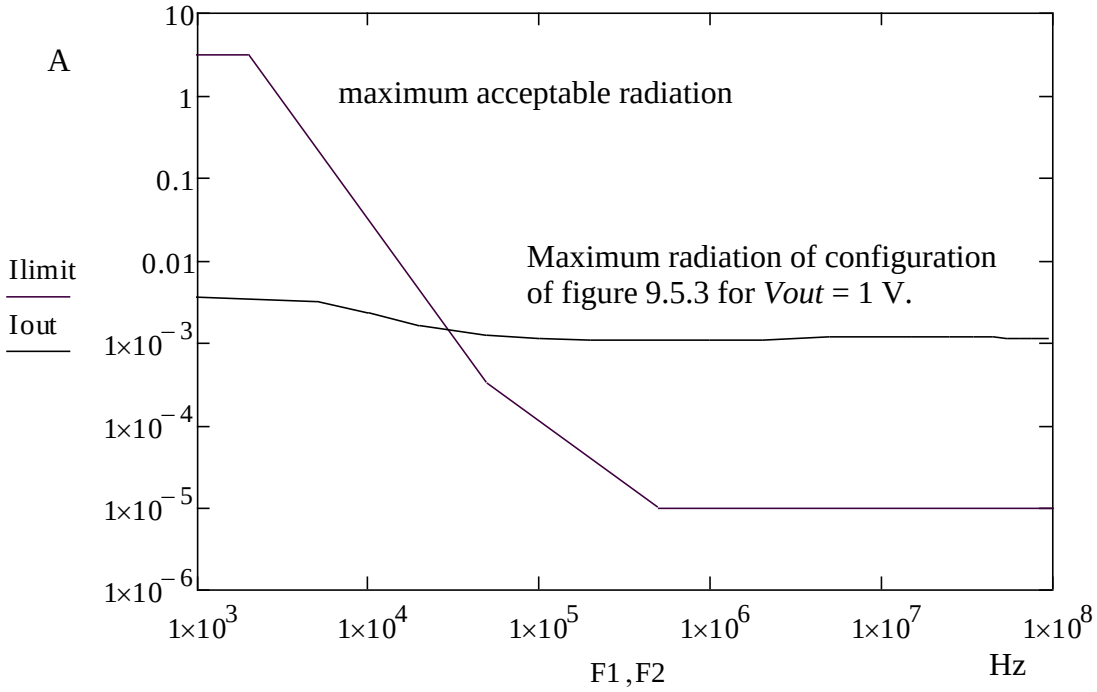

Figure 9.5.4 Comparing the response of the proposed design with the emission requirements