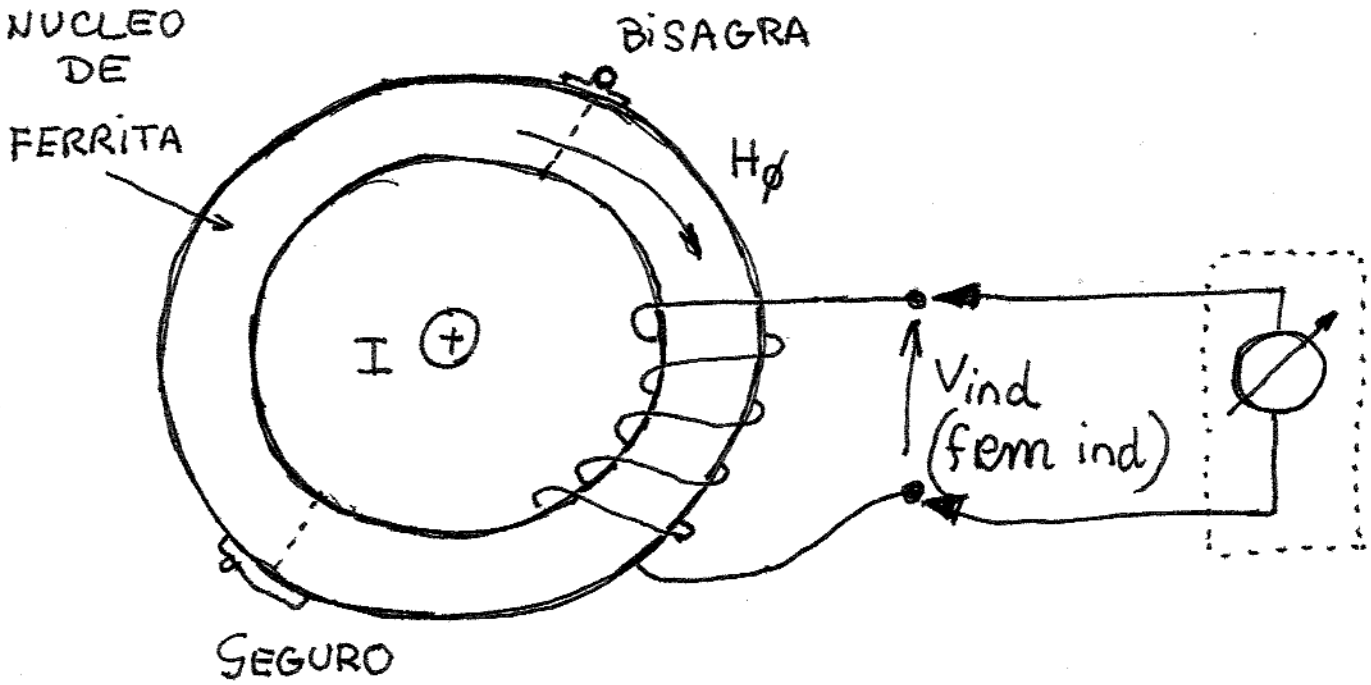
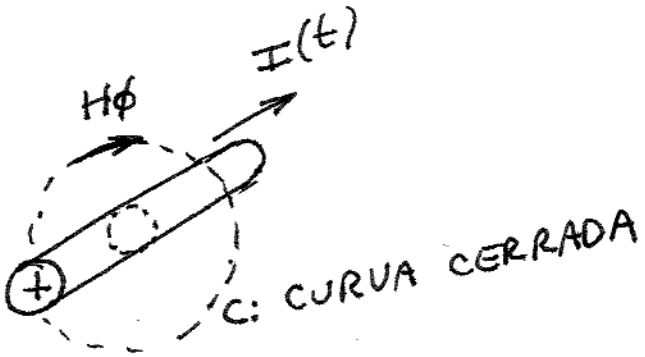
PUNTA DE CORRIENTE



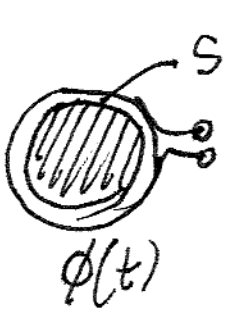


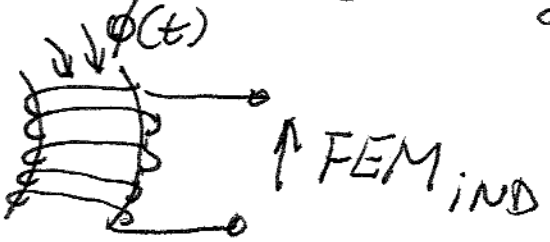
LEY DE AMPERE

$$\oint_C \vec{H}\cdot d\vec{l} = \int_S \vec{J}\cdot d\vec{S} + \int_S \frac{d\vec{D}}{dt}\cdot d\vec{S}$$

LEY DE FARADAY

$$\#FEM_{IND} = -\frac{\partial \vec{\phi}}{\partial t}$$





IMPEDANCIA DE TRANSFERENCIA

$$Z_T = \frac{V_{ind}}{I}$$

SE OBTIENE UNA CURVA DE CALIBRACIÓN Z_T(frec)

I: CORRIENTE A MEDIR **(CONOCIDA)**

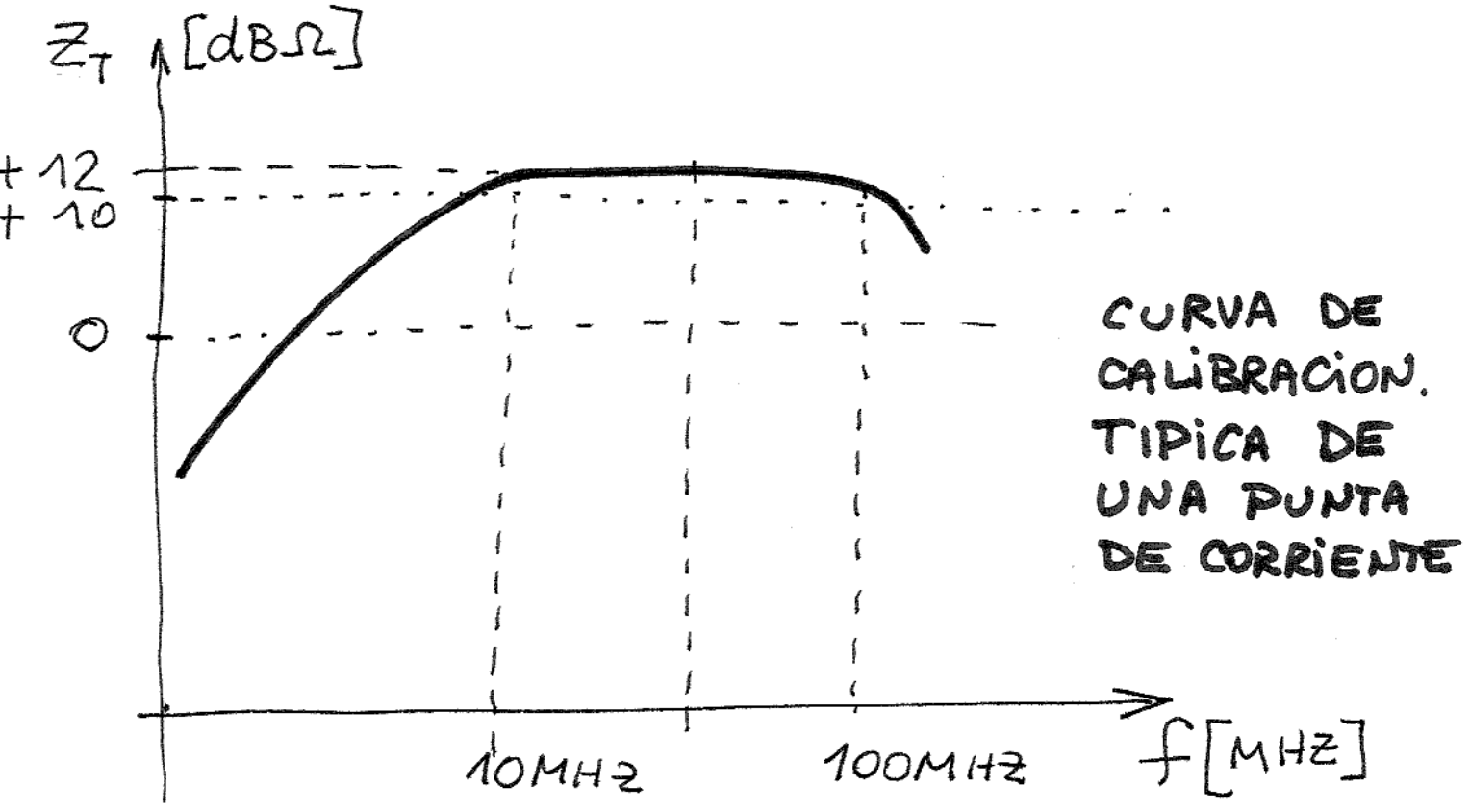
Vind: TENSION EN EL ARROLLAMIENTO **(MEDIDA)**

GENERALMENTE SE DA:

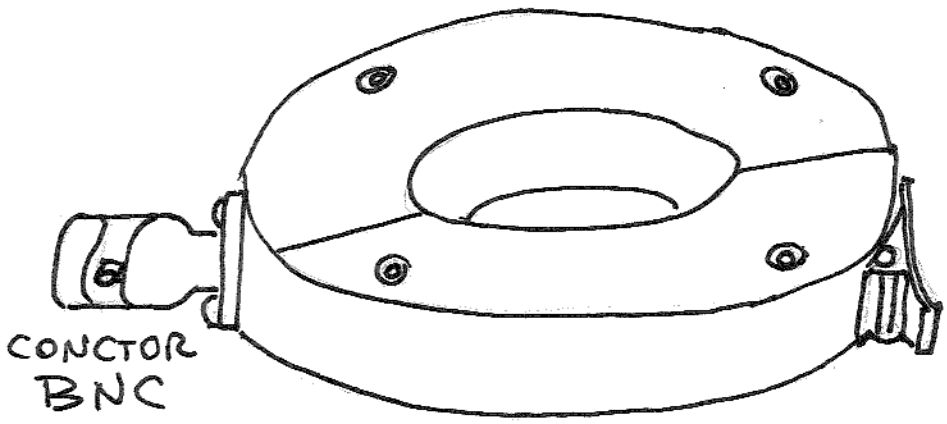
$$|Z_T|_{dB\Omega} = |V|_{dB\mu V} - |I|_{dB\mu A}$$

(dB RELATIVOS A 1Ω)

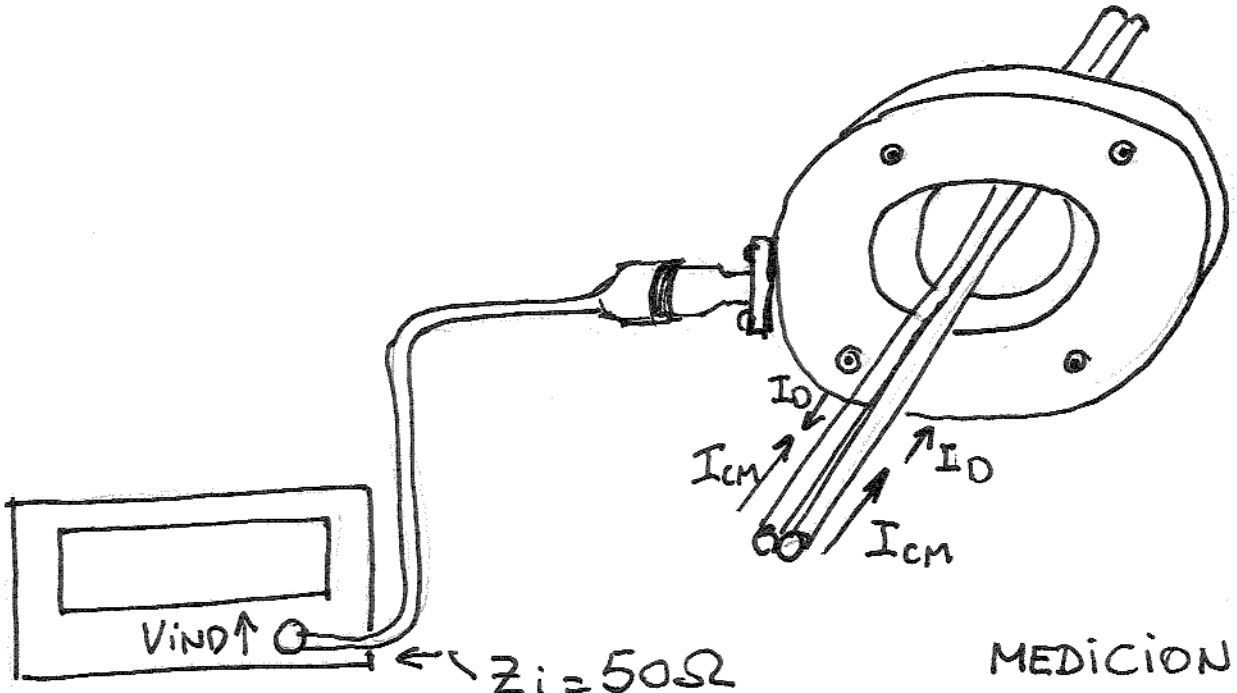
EJEMPLO $12\,dB\Omega$ DE 10 A 100 MHZ



SIRVE PARA MEDIR I_{MC} ENTRE 10MHz Y 100MHz



PUNTA DE CORRIENTE O SENSOR DE CORRIENTE



ANALIZADOR DE ESPECTRO

MEDICION DE VINDUCIDA

I_{CM} : CORRIENTE DE MC A DETERMINAR

EJEMPLO:

DEL EJEMPLO ANTERIOR

CISPR 22 DICE E_{MAX} 100 $\mu V/m$ $d = 10m$ (40 $dB\mu V/m$) $f = 30MHz$

$\Delta L = 1m$ CABLE

$I_{MAX}|_{M.COMUN} = 26{,}5\mu A \cdot (28{,}46\ dB\mu A)$

$$|V|_{dB\mu V} = |I|_{dB\mu A} + |Z_T|_{dB\Omega}$$

$$|V|_{dB\mu V} = 28{,}5 dB\mu A + 12 dB\Omega$$

$$|V|_{dB\mu V} = 40{,}46 dB\mu V.$$

$$20 \log \frac{V}{1\mu V} = 40{,}46 dB\mu V.$$

$$V = 10^{\frac{40{,}46}{20}} \cdot \mu V. = 105{,}5\mu V.$$

$$\boxed{V = 105{,}5\mu V}$$

TENSION MEDIDA MAXIMA EN LA SONDA DE CORRIENTE PARA CUMPLIR LA NORMA.

SE HA VISTO PARA MODO COMÚN EL $|E_{MAX}|$

$$|E_{MAX}| = 1{,}256 \cdot 10^{-6} \frac{\Delta L \cdot I_0 \cdot f}{d} \left[V/m\right]$$

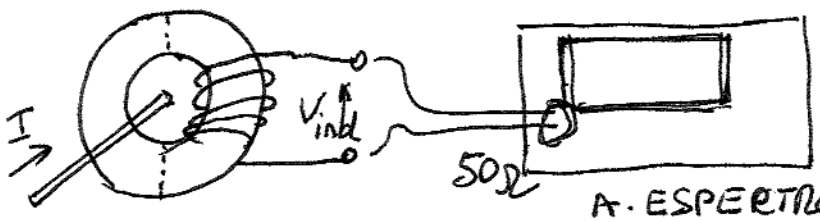
SI SE REEMPLAZA $Z_T = \frac{V_{ind}}{I}$

$$|E_{MAX}| = 1{,}256 \cdot 10^{-6} \frac{\Delta L \cdot |V_{ind}| \cdot f}{d \cdot |Z_T|}$$

$$|V_{ind}| = \frac{|E_{MAX}| \, d \, |Z_T|}{1{,}256 \cdot 10^{-6} \cdot \Delta L \cdot f} \quad [\mu V]$$

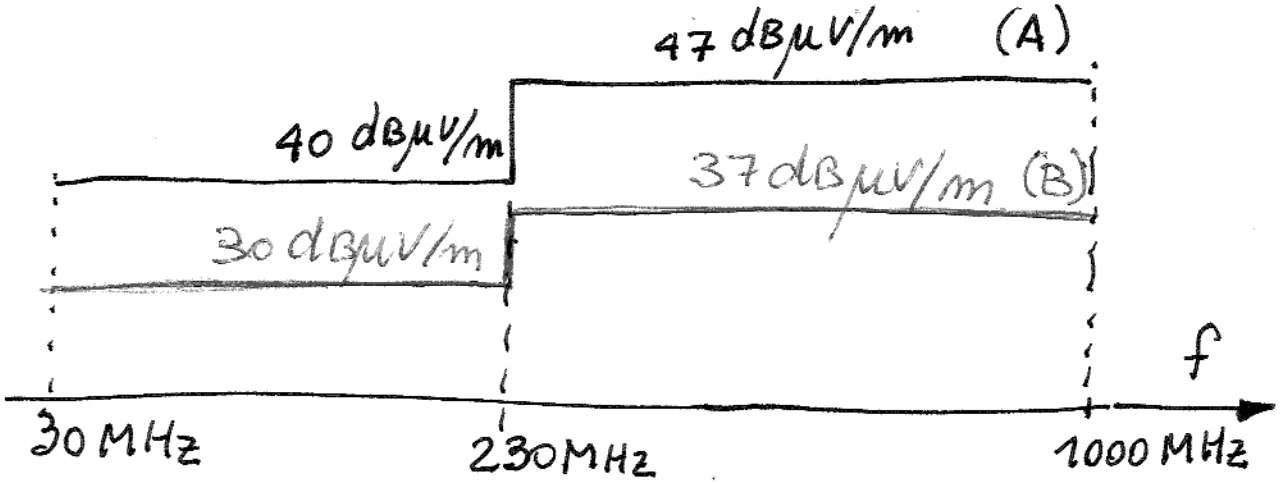
$$|V_{ind}|_{dB\mu V} = E_{MAX}(dB\mu V/m) + |Z_T|_{dB\Omega} + 20 \log d - 20 \log f(MHz) - 20 \log \Delta L - 20 \log(1{,}256 \cdot 10^{-6})$$

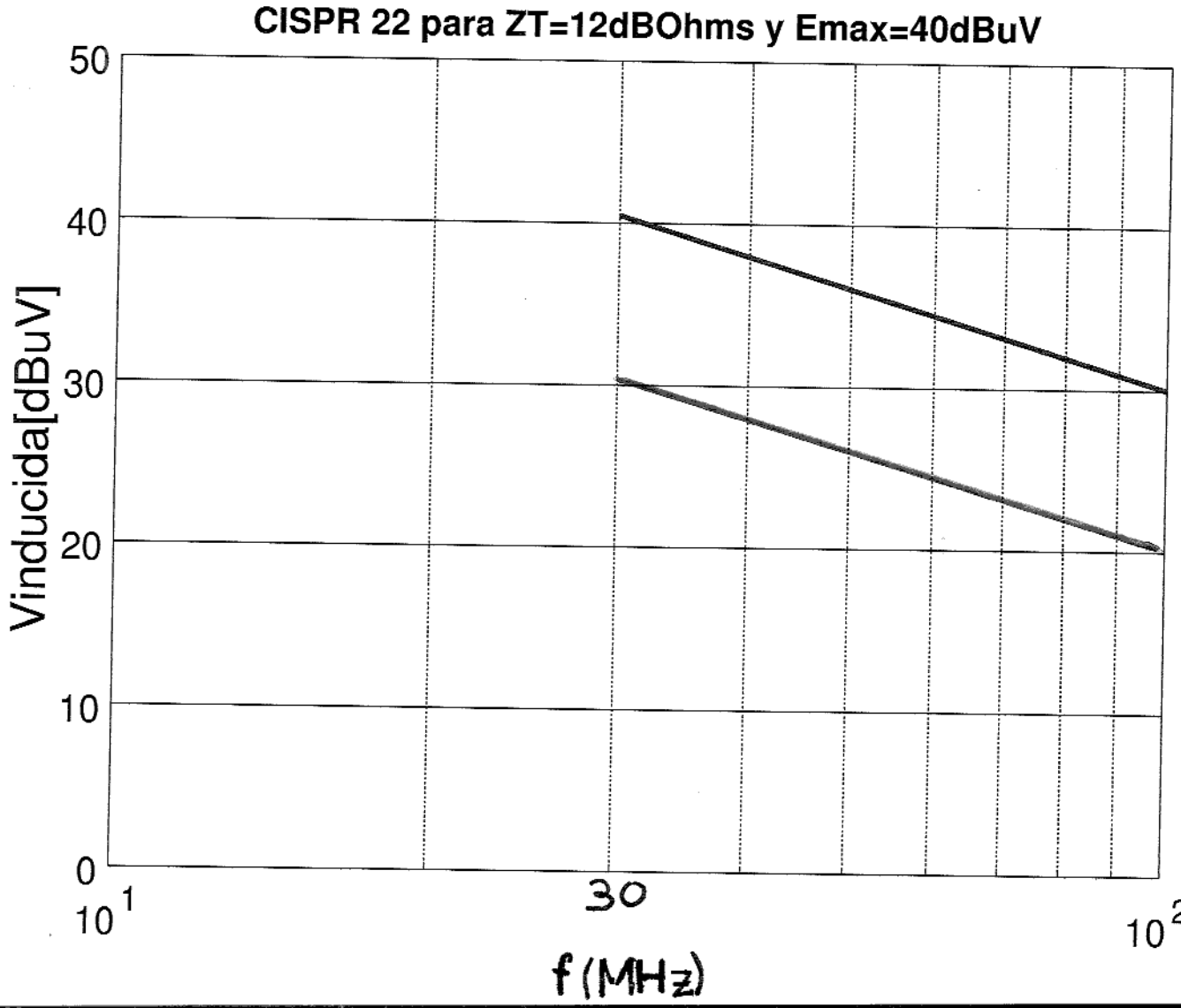
DADO UN CAMPO MAXIMO PARA LA I. DE M. COMUN Y LA PUNTA DE CORRIENTE CON SU Z_T, SE OBTIENE LA TENSION INDUCIDA MAXIMA QUE SE DEBE MEDIR EN EL ANALIZADOR DE ESPECTRO



$$|V_{ind.}| = 40 dB\mu V/m + 12 dB\Omega + 20 \log 10 - 20 \log(30 \cdot 10^6) - 20 \log 1 - 20 \log(1{,}256 \cdot 10^{-6}) = 40 dB\mu V.$$

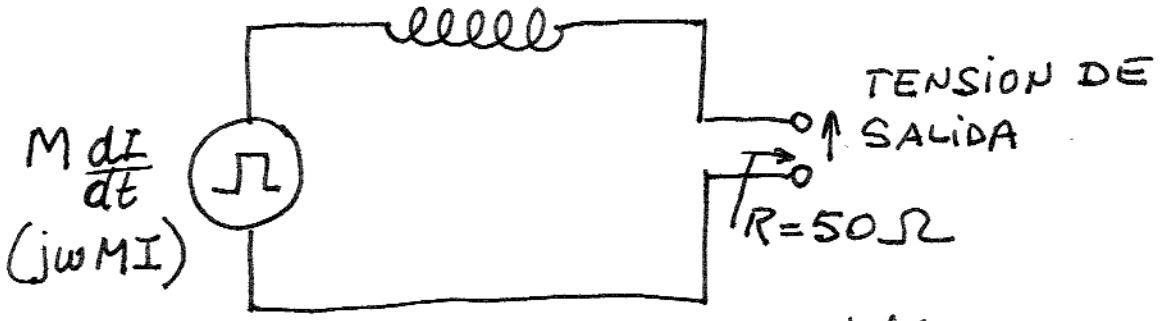
CISPR 22 , d=10m

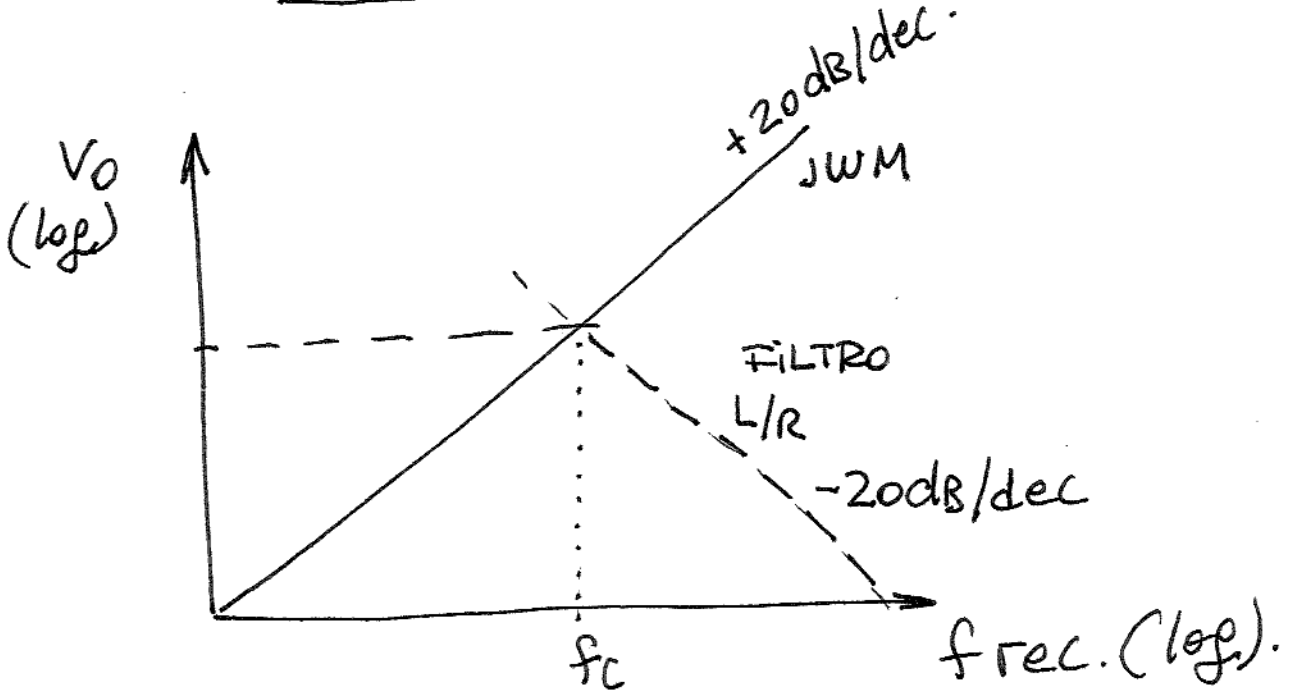


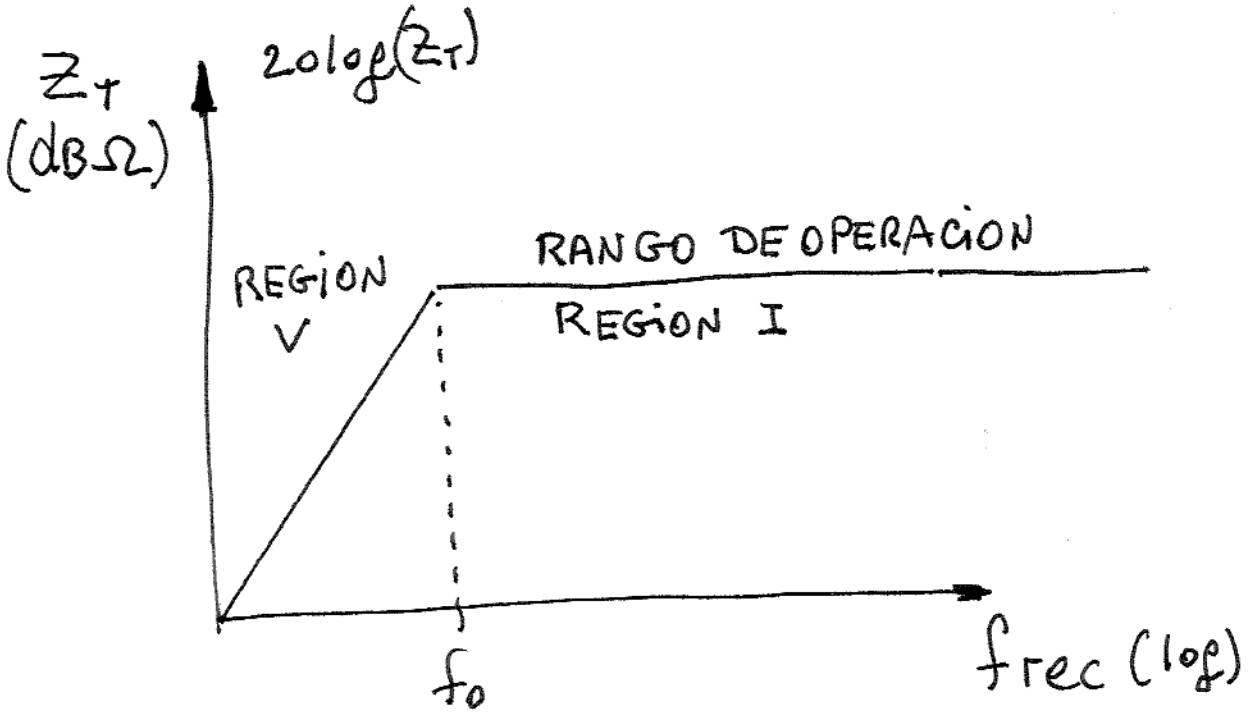


CIRCUITO EQUIVALENTE

L (AUTOINDUCTANCIA).

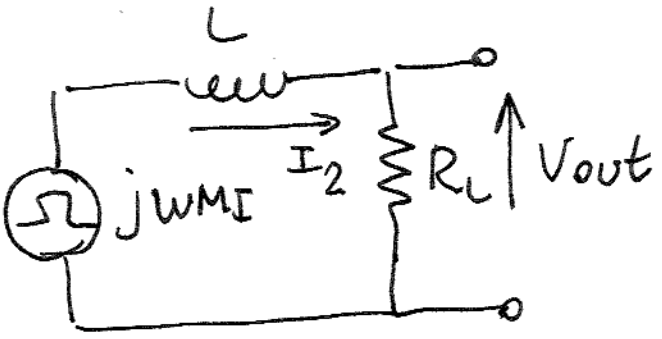






RESPUESTA TÍPICA

EN $f_o, f_c (X_L \equiv R_L)$



I : CORRIENTE EN EL PRIMARIO.

$$Vout = j\omega M I \frac{R_L}{R_L + j\omega L}$$

$$Z_t = \frac{Vout}{I} = \frac{j\omega M \cancel{I}}{\cancel{I}} \cdot \frac{R_L}{R_L + j\omega L}$$

$$Z_t = \frac{j\omega M R_L}{R_L + j\omega L}$$

$$Z_t \cong \frac{\cancel{j\omega} M R_L}{\cancel{j\omega} L} = \left(\frac{M}{L}\right) R_L \quad (\text{Si } \omega L \gg R_L)$$

PARA f_c : $X_L = R_L$

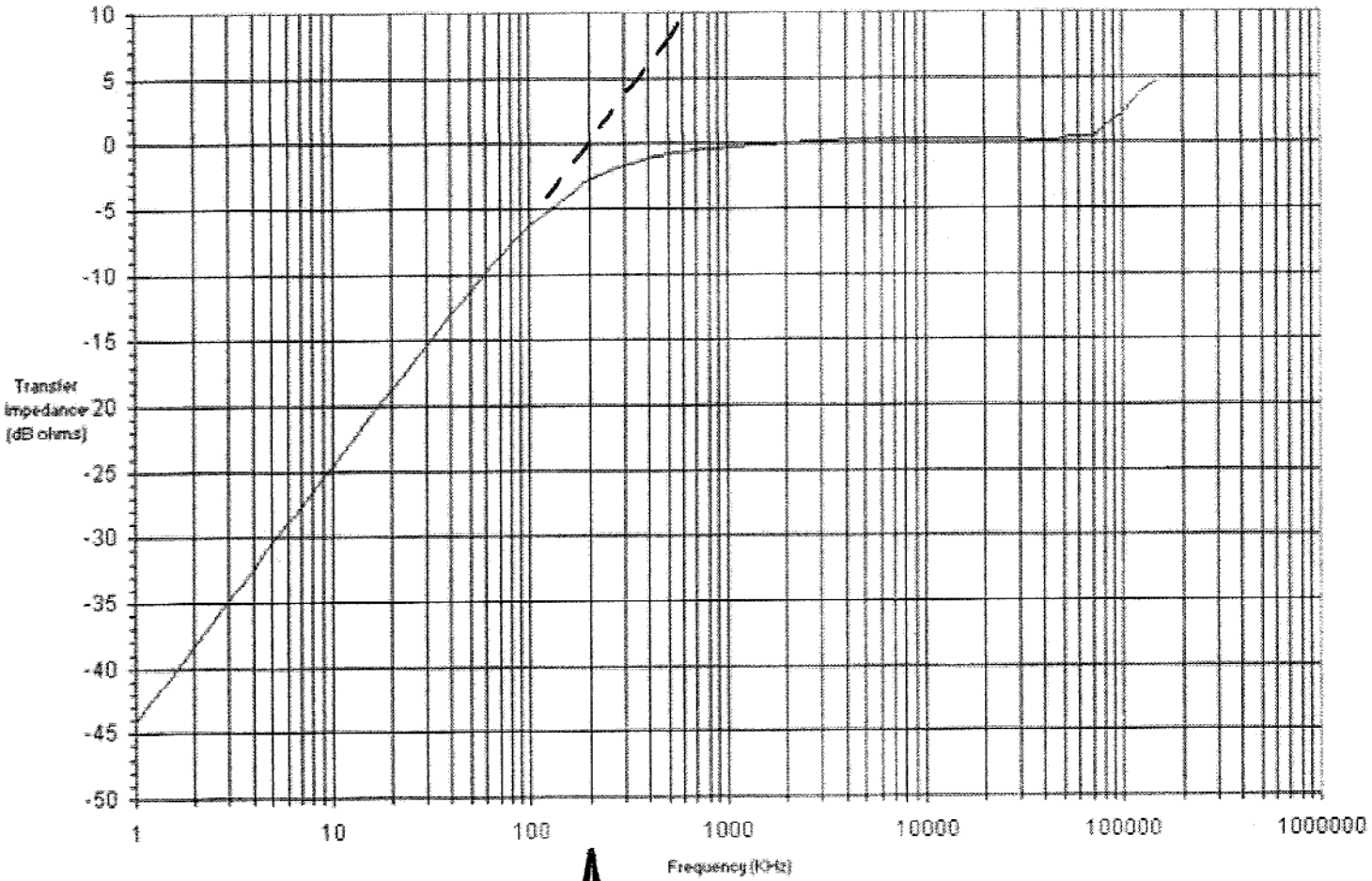
$$2\pi f_c L = R_L$$

$$Z_t = \frac{M}{\cancel{L}} \cdot 2\pi f_c \cancel{L}$$

$$\boxed{M = \frac{Z_t}{2\pi f_c}}$$

SE PUEDE CALCULAR M CONOCIDA Z_t Y f_c. DE LA PUNTA

BROADBAND CURRENT PROBE BCP-611
10 KHz - 150 MHz



$f_c = 200\ KHz$

$Z_t = 0\ dB\Omega \longrightarrow Z_t = 1\Omega$

$$M \doteq \frac{Z_t}{2\pi f_c} = \frac{1\Omega}{2\pi \cdot 200 \cdot 10^3\ Hz} = 0{,}8 \cdot 10^{-6}\ H$$

COMO $Z_t = \dfrac{j\omega M R_L}{R_L + j\omega L}$.

PARA $f = 10MHz$ $\omega L \gg R_L$. $Z_t \cong 1\Omega$.

$$Z_t = \frac{j\omega M R_L}{j\omega L} = \frac{M R_L}{L}.$$

$$L = \frac{M R_L}{Z_t} = \frac{0{,}8 \cdot 10^{-6} H \; 50\Omega}{1\Omega} =$$

$$\boxed{L = 40\,\mu H}$$

EN RESONANCIA

$$\frac{\omega_c L}{R_L} = 1.$$

$$\omega_c = \frac{R_L}{L} =$$

$$f_c = \frac{R_L}{2\pi L} = \frac{50\Omega}{2\pi \cdot 40 \cdot 10^{-6} H} = \boxed{200KHz}$$

Verifica o.k.