

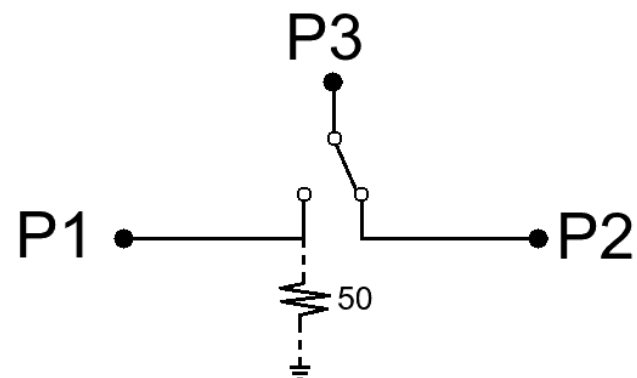
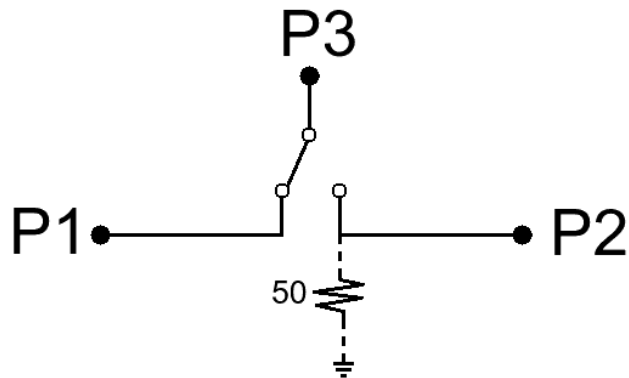
RF SWITCH

- Carducci, Nahuel
- Cinetto, Cristian
- Demski, Andrés
- Kukulanski, Ariel
- Paunovic, Iván

Índice

- Descripción del proyecto.
- Diodos PIN.
- Esquema ideal.
- Bias Tee.
- Esquema final.
- Desarrollo del PCB.
- Sets de medición.
- Mediciones y Simulaciones.
- Conclusiones

Switch SPDT



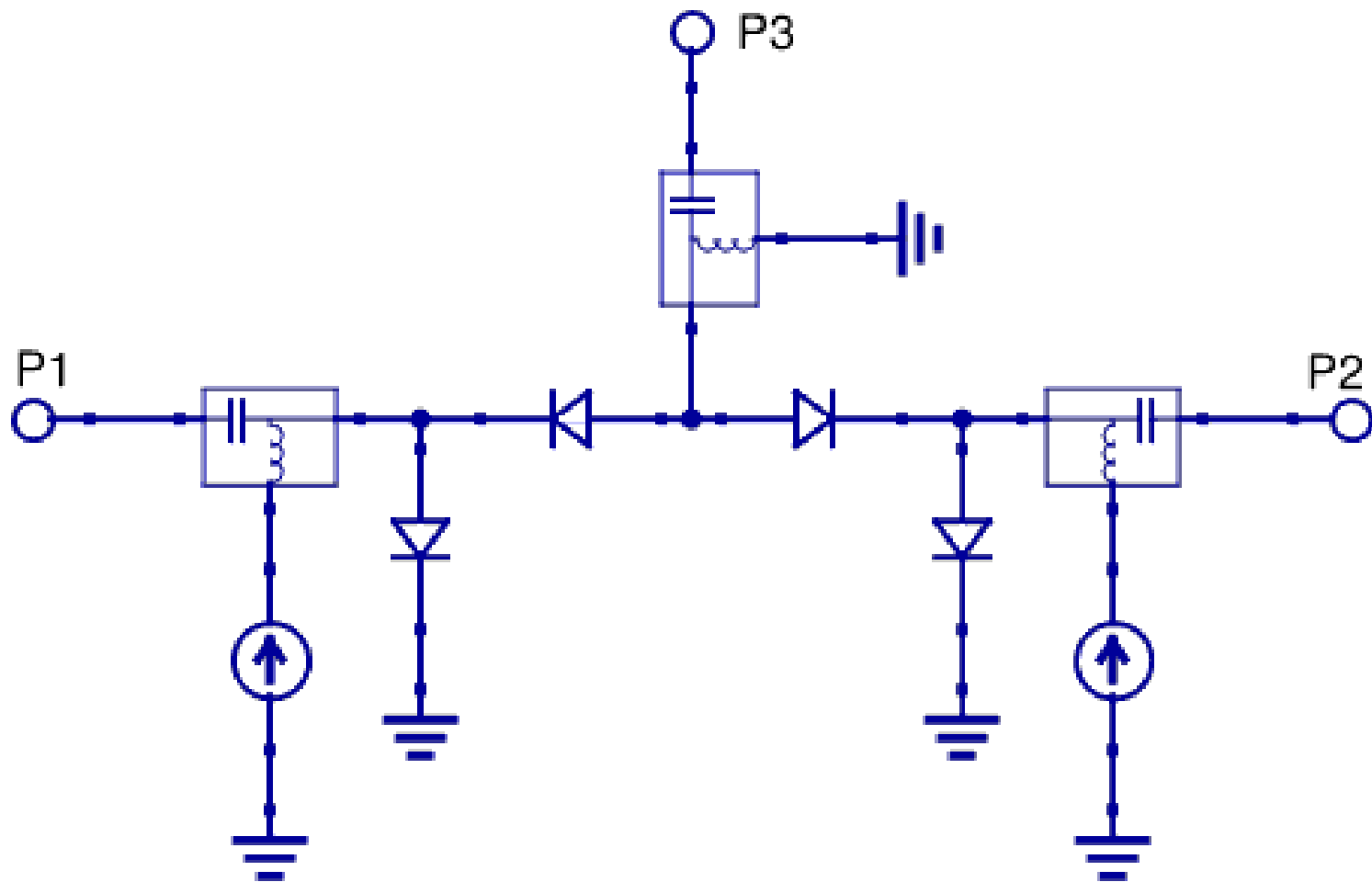
$$\overline{\mathbf{S}}_A = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$$

$$\overline{\mathbf{S}}_B = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$$

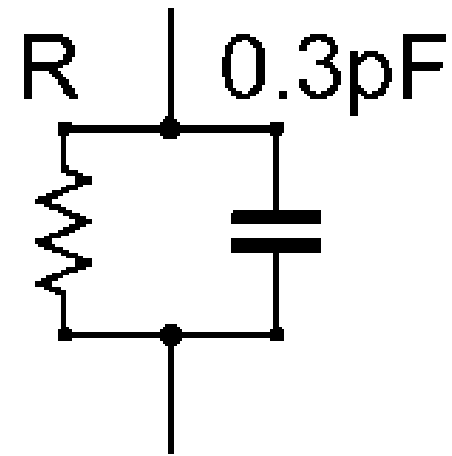
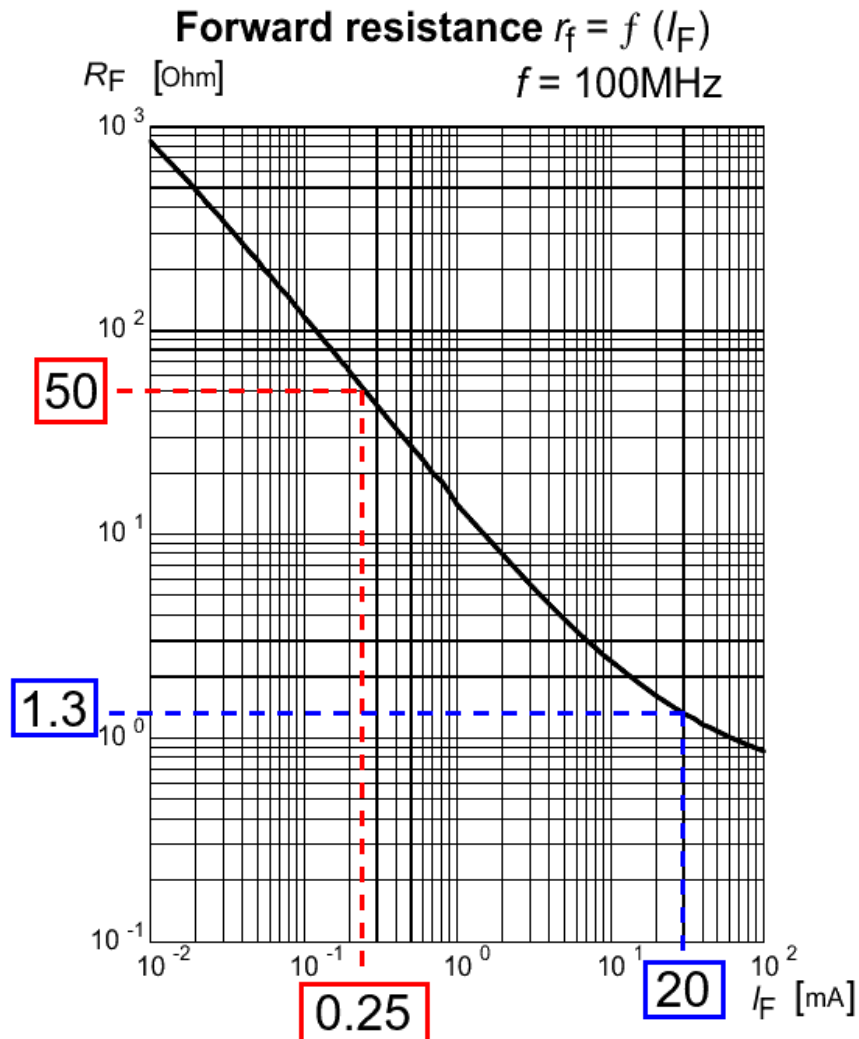
Switch SPDT - Especificaciones

- Funcional hasta 3 GHz
- Ancho de banda de al menos 1 década
- Carga fantasma de 50 ohm en puerto desconectado

Esquema ideal

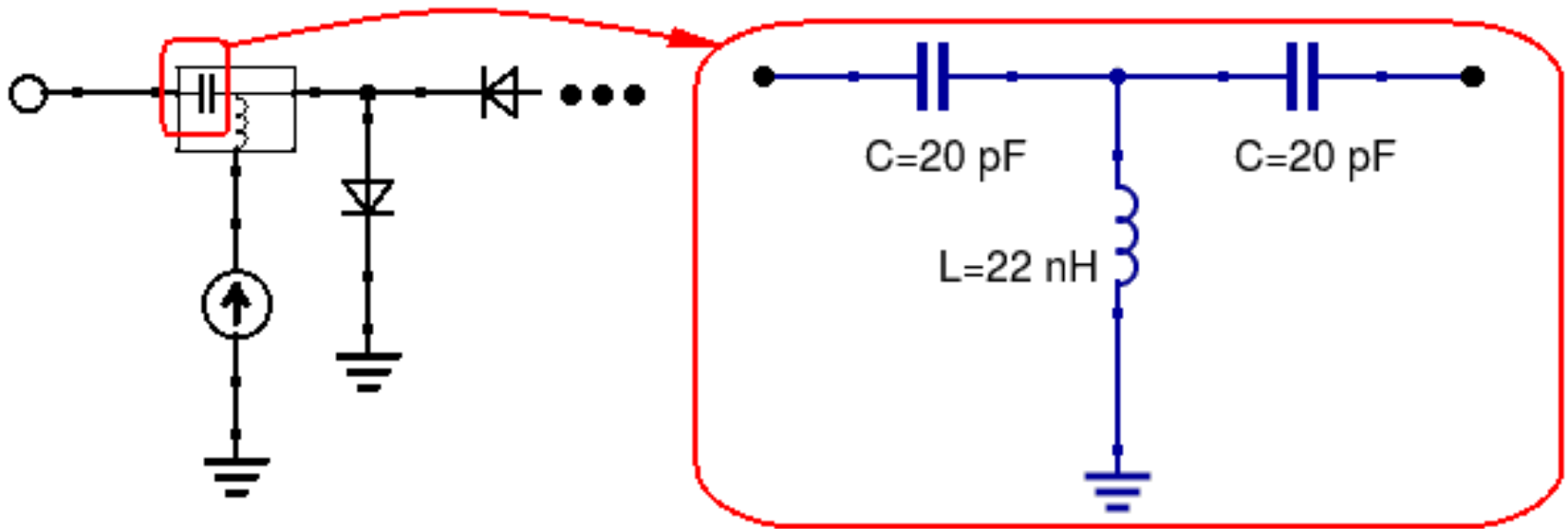


Características del Diodo PIN



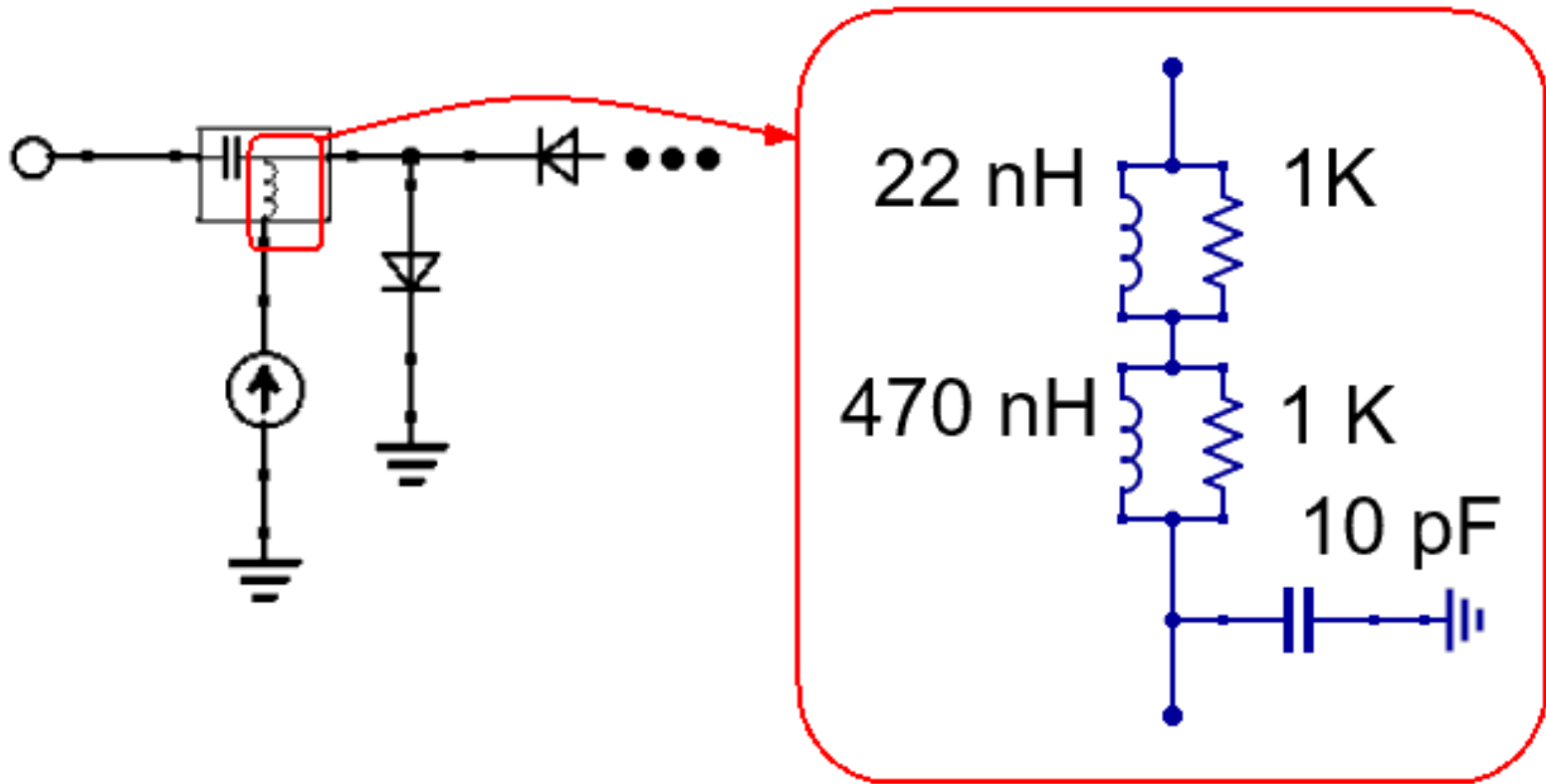
Capacitor de Desacople de CC

- Implementación: Filtro T

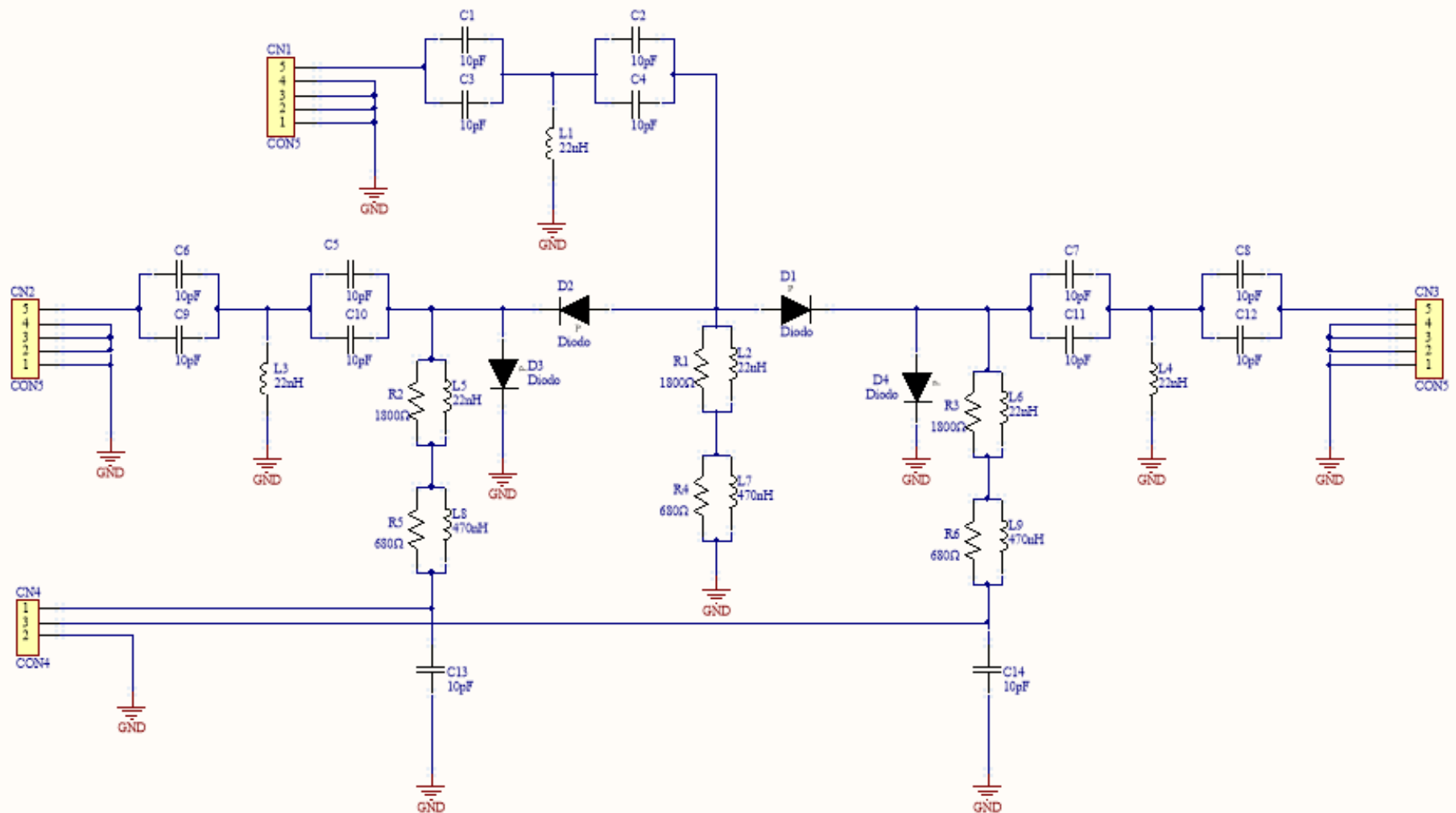


Desacople de AC - Choque

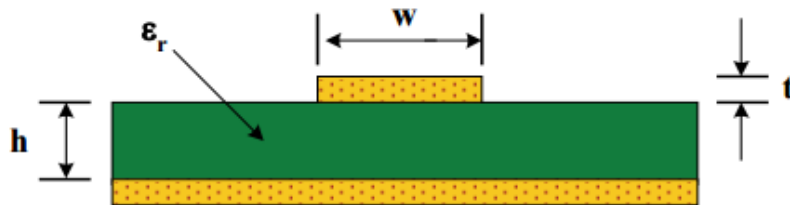
- Implementación



Circuito Final - Schematic



Consideraciones

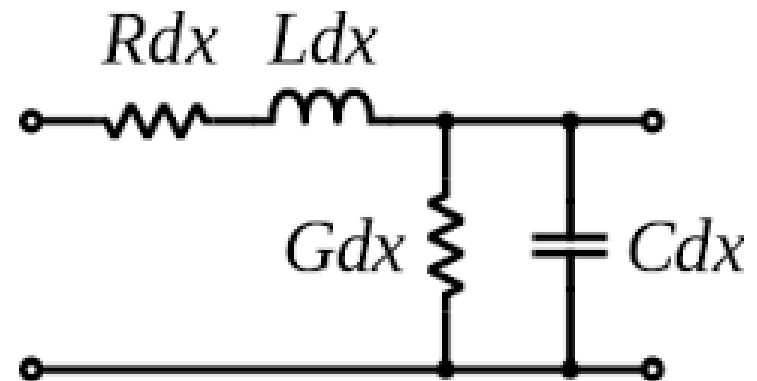


x = length of trace (cm)
w = width of trace (cm)
h = height of trace (cm)
t = thickness of trace (cm)
ε_r = PCB Permeability

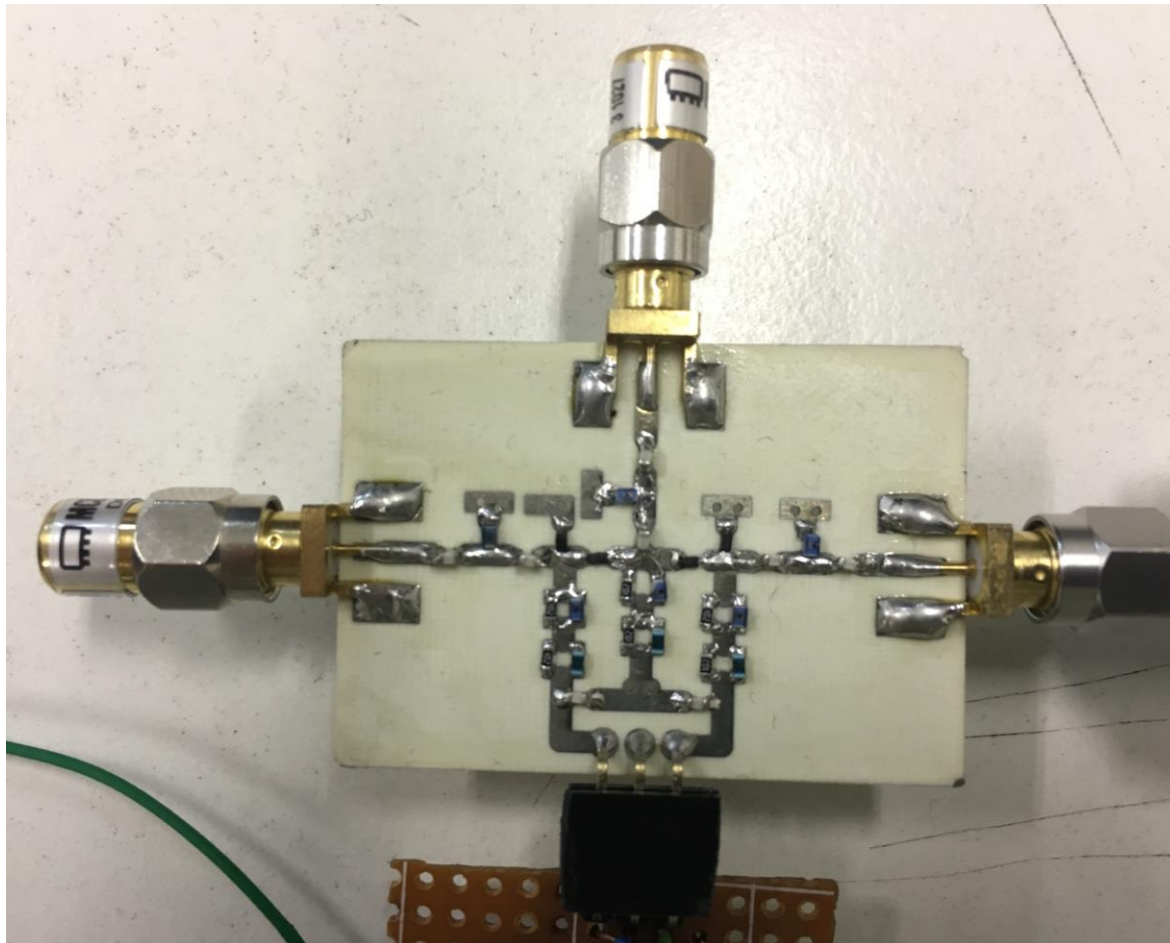
$$L(nH) \approx 2x \ln \left(\frac{5.98 h}{0.8 w + t} \right)$$

$$C(pF) \approx \frac{0.264x (\epsilon_r + 1.41)}{\ln \left(\frac{5.98 h}{0.8 w + t} \right)}$$

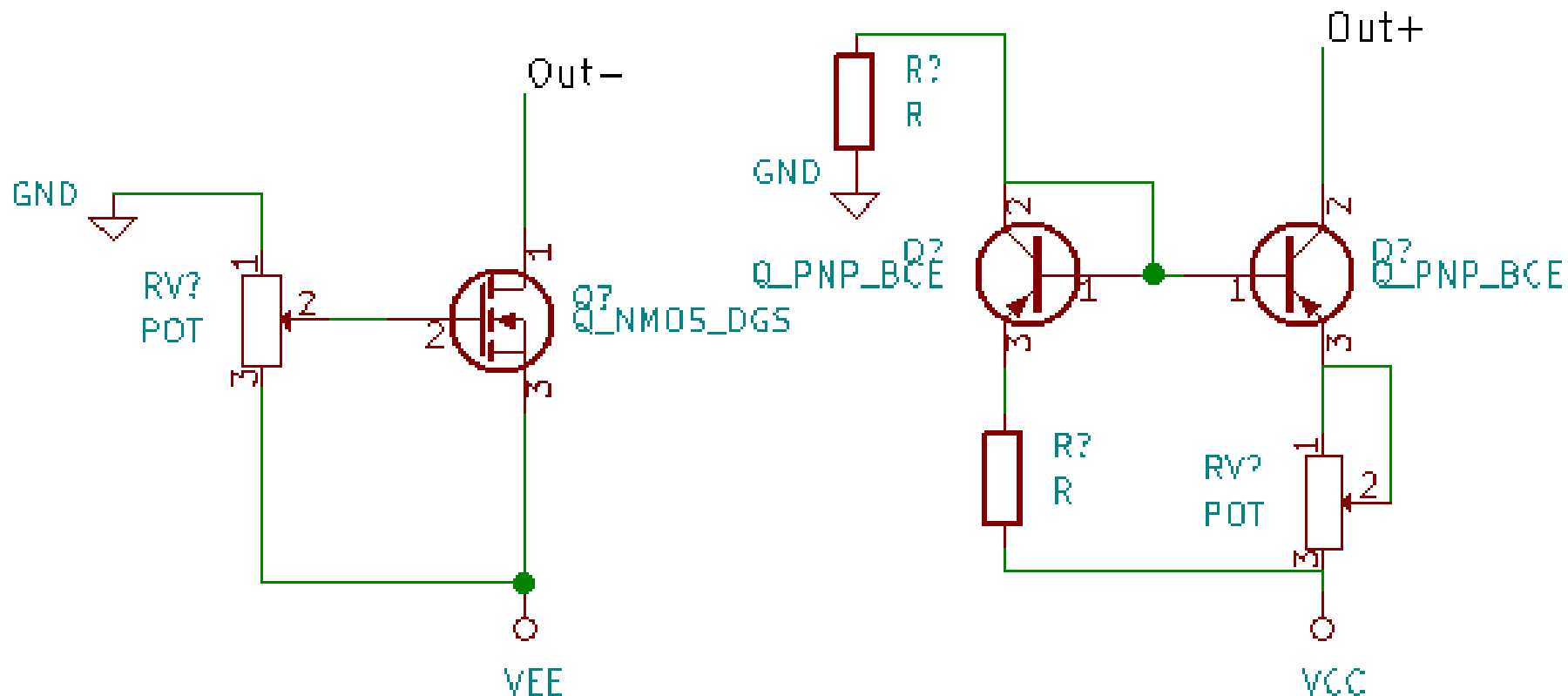
$$Z_0(\Omega) = 31.6 \sqrt{\frac{L(nH)}{C(pF)}} \quad T_p(ps/cm) = 31.6 \sqrt{L(nH)C(pF)}$$



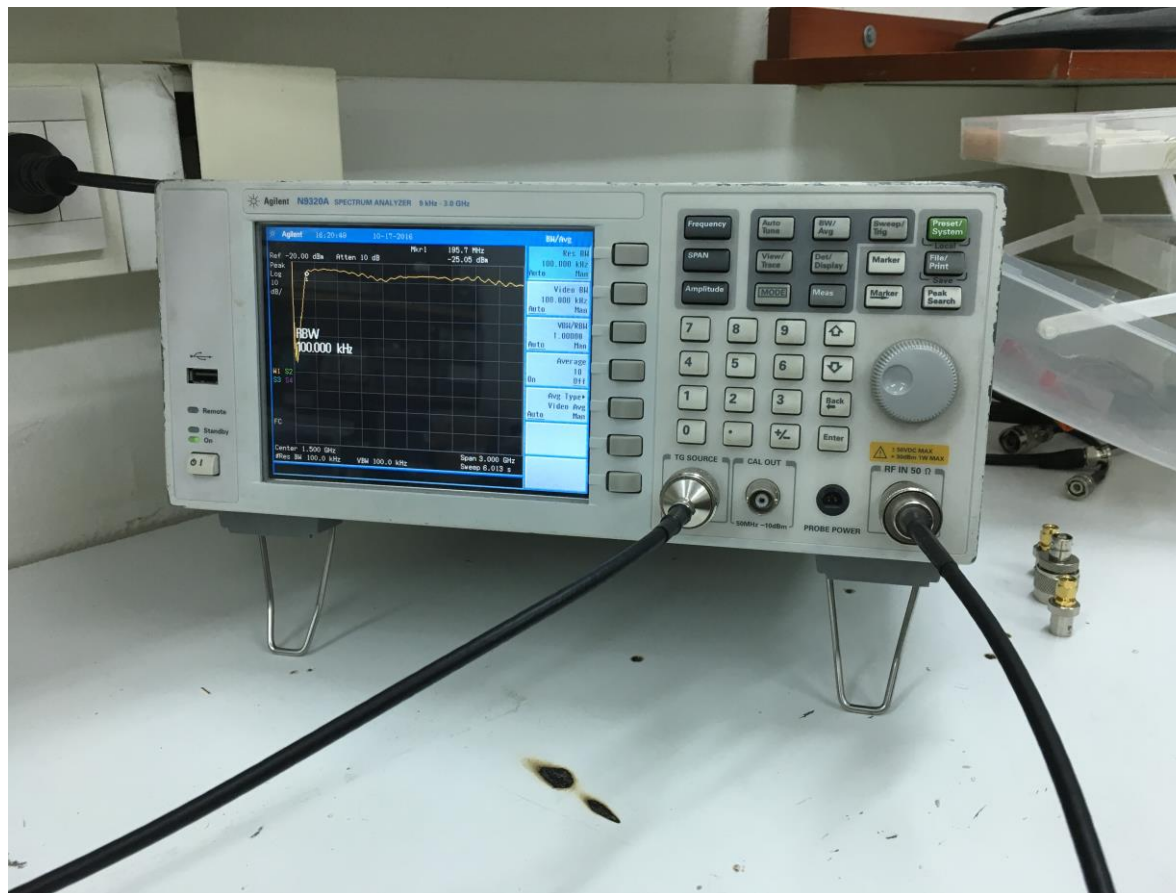
Placa realizada



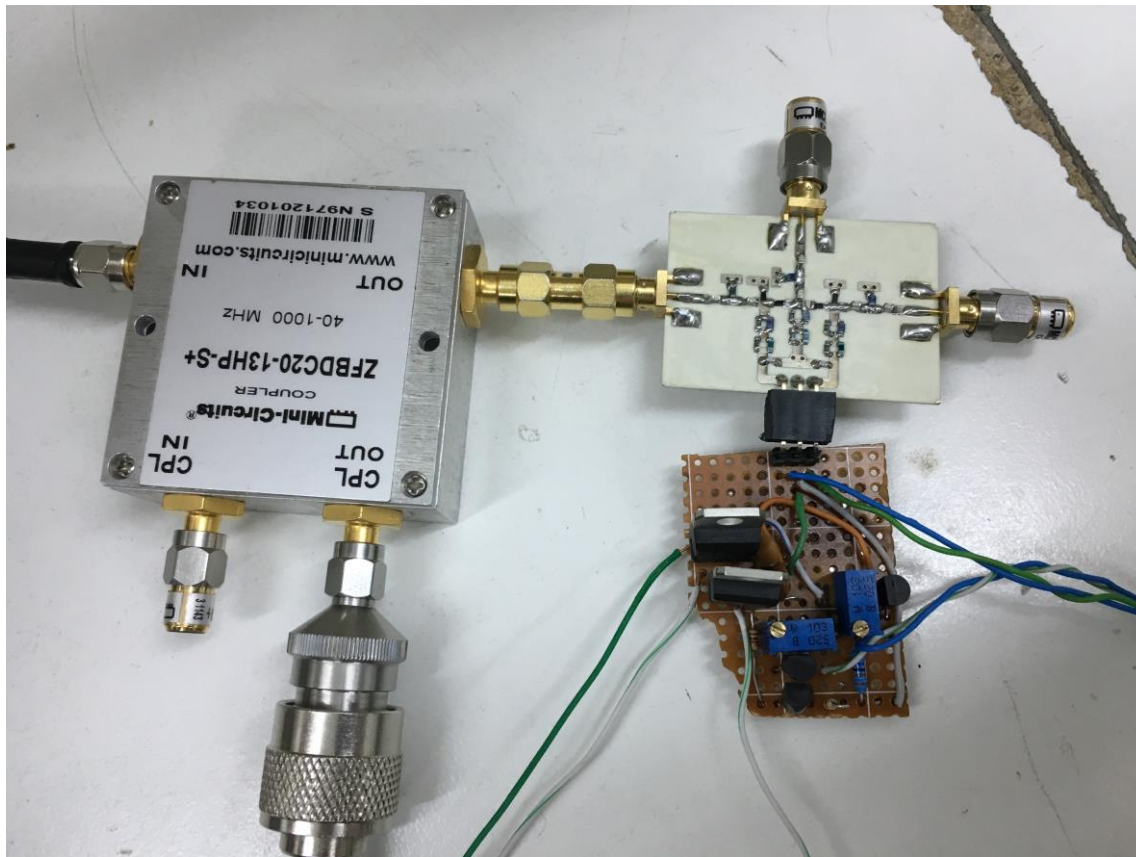
Placa de Polarización



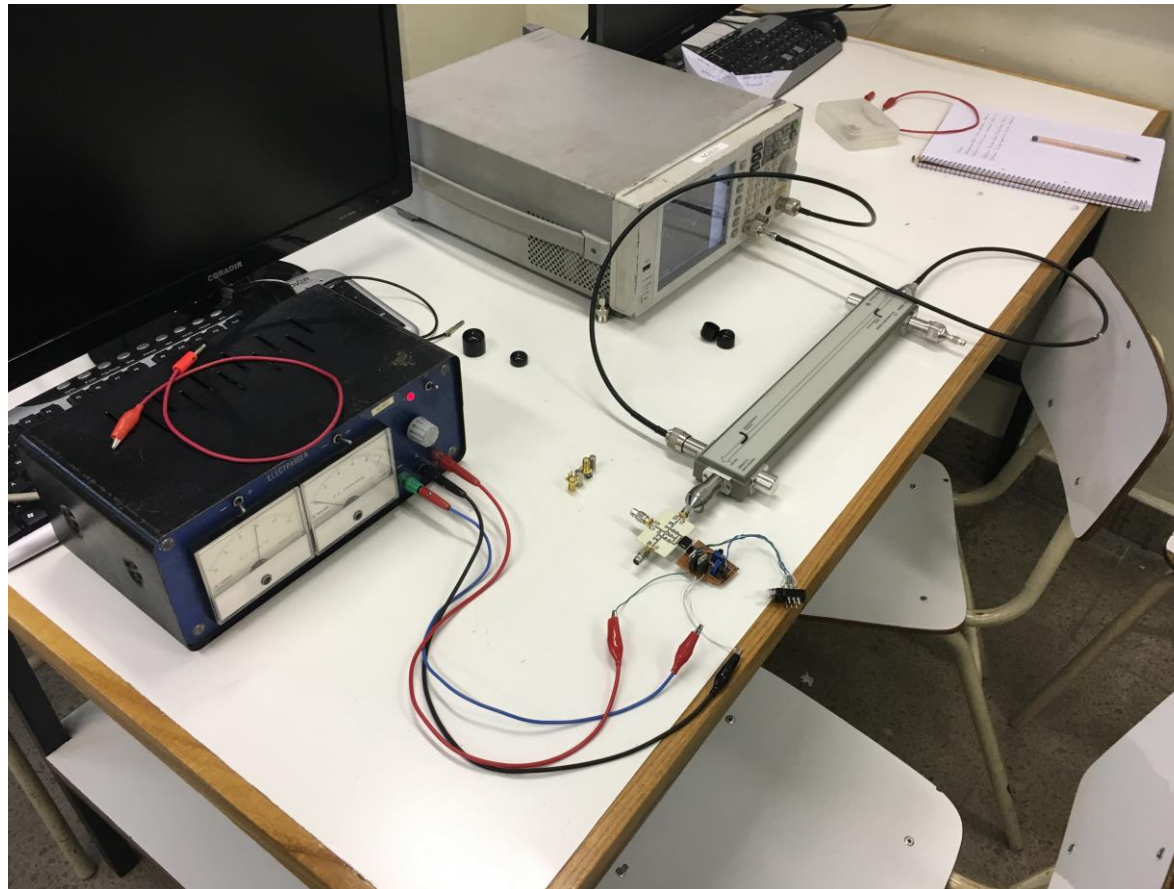
Medición con AE: Tracking Generator



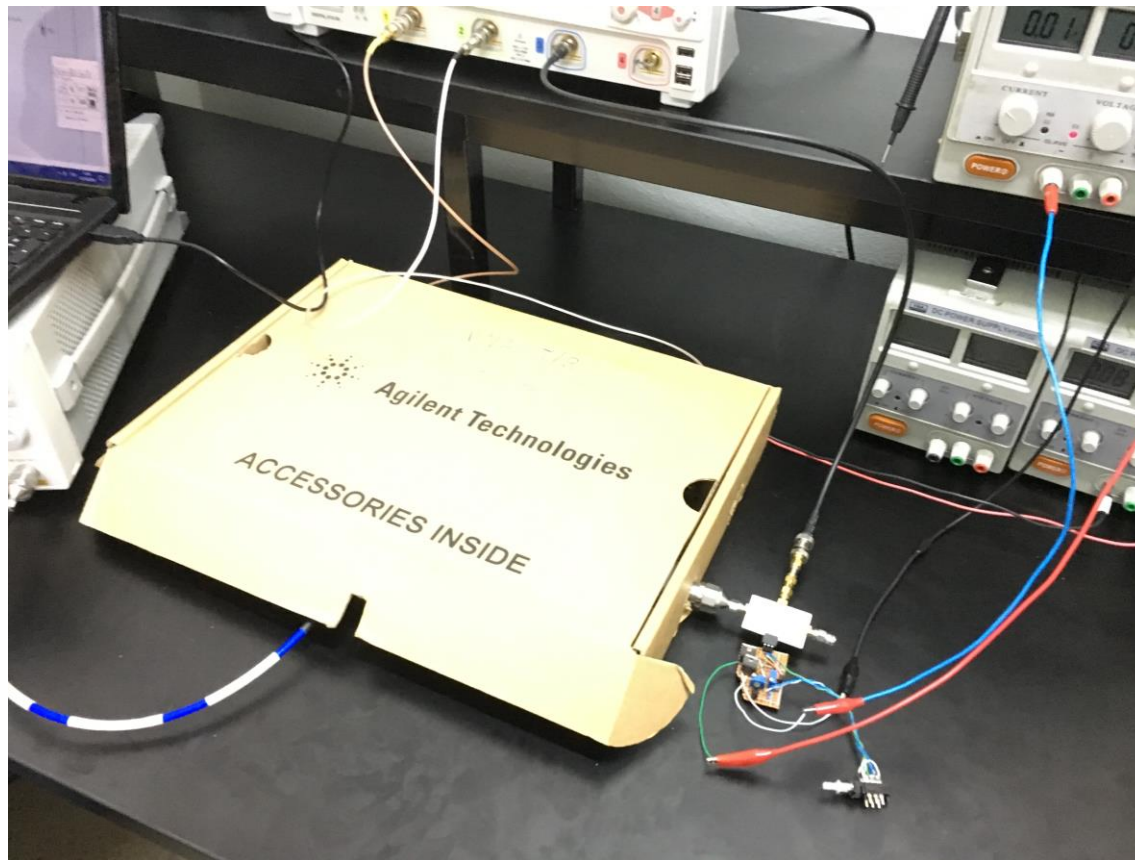
Medición con AE: Setup Preliminar



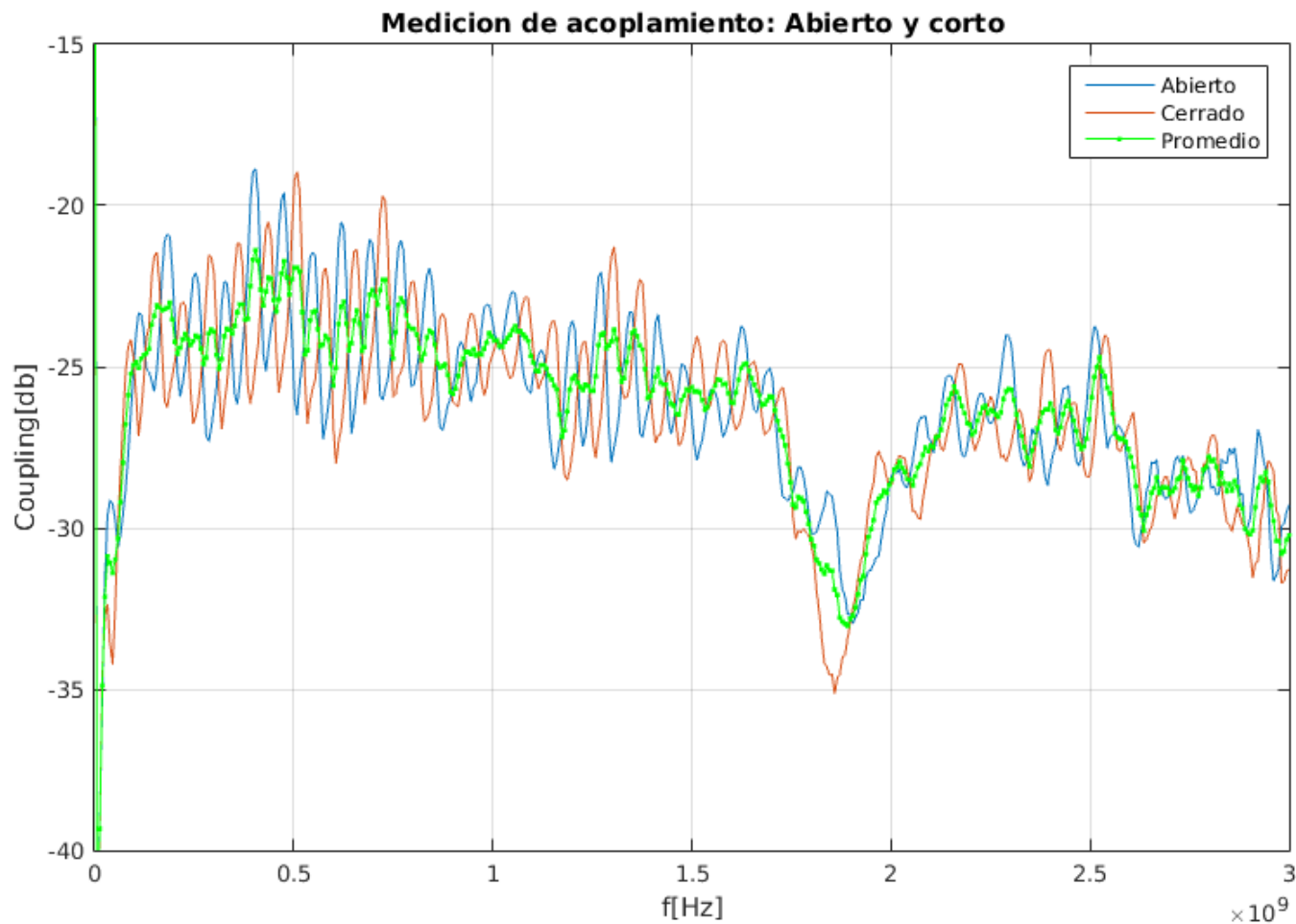
Medición con AE: Setup Final



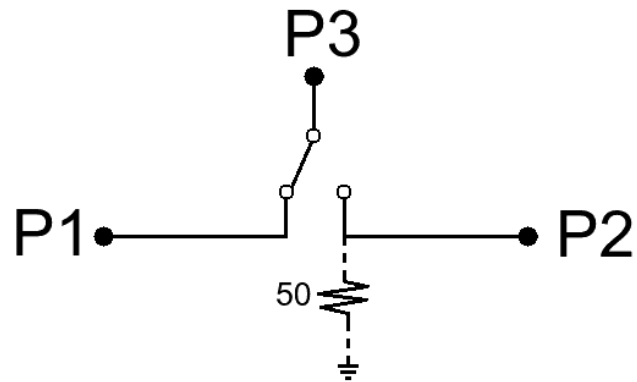
Medición con VNA: Setup



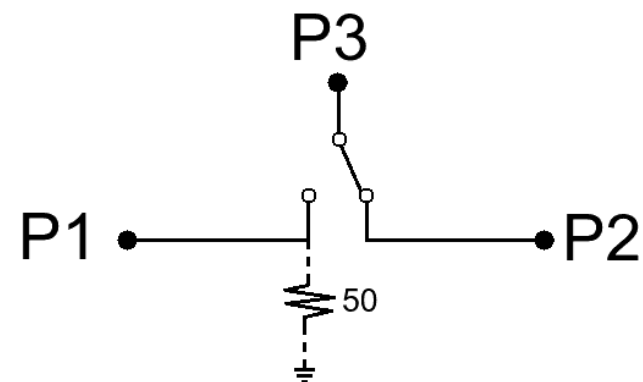
Medición con AE: Normalizacion



Parámetros S

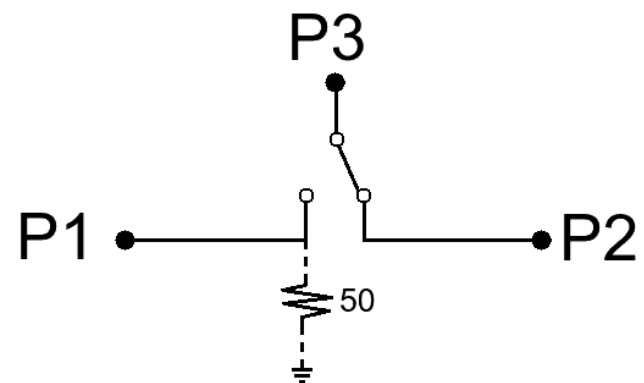
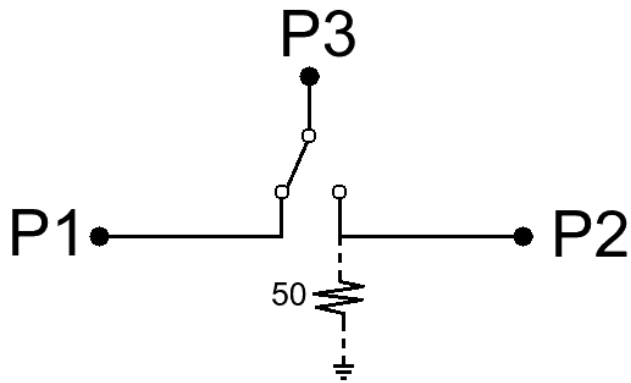


$$\overline{\mathbf{S}}_A = \begin{bmatrix} \textcircled{S_{11}} & S_{12} & S_{13} \\ \textcircled{S_{21}} & S_{22} & S_{23} \\ \textcircled{S_{31}} & S_{32} & \textcircled{S_{33}} \end{bmatrix}$$



$$\overline{\mathbf{S}}_B = \begin{bmatrix} \textcircled{S_{11}} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ \textcircled{S_{31}} & S_{32} & S_{33} \end{bmatrix}$$

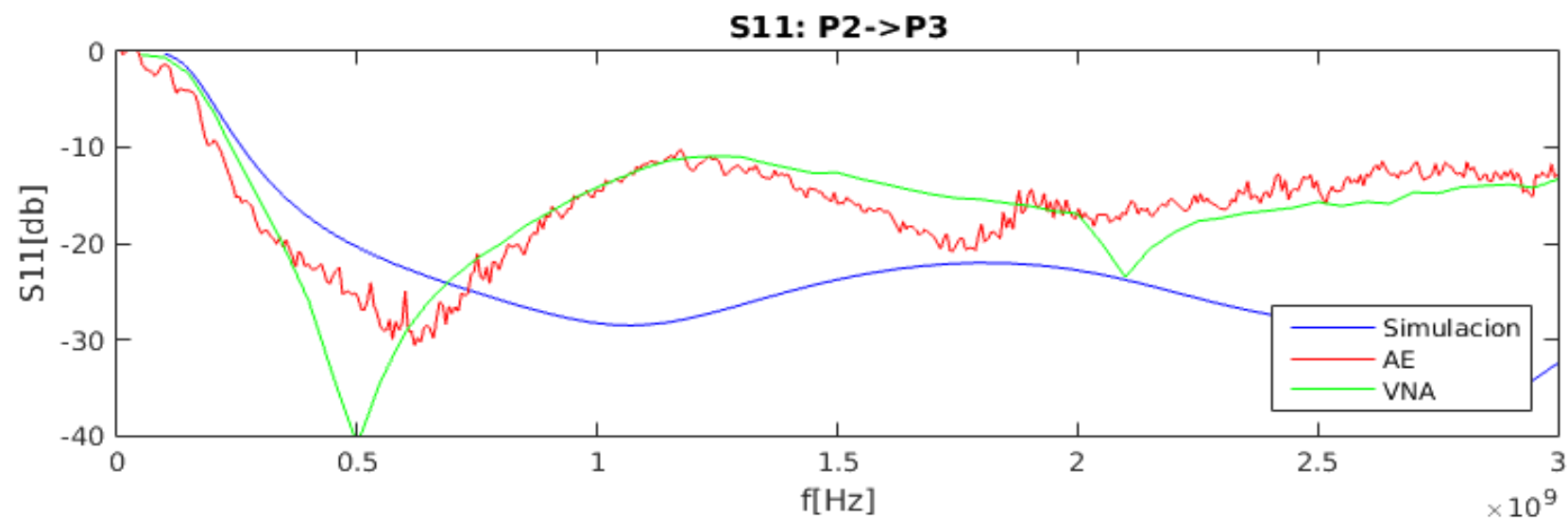
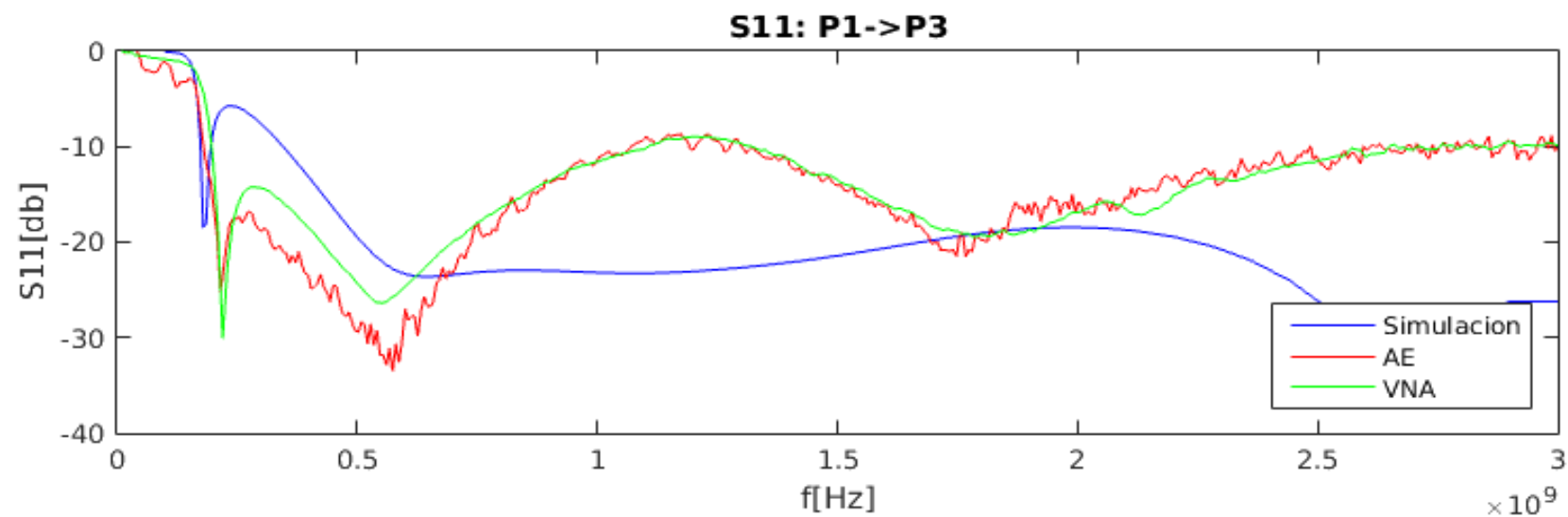
S11



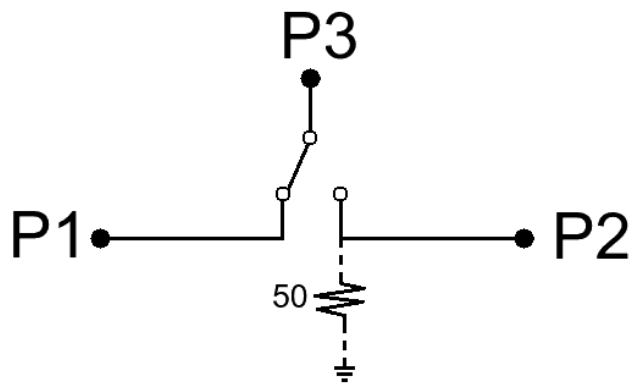
$$\overline{\mathbf{S}}_A = \begin{bmatrix} \textcircled{S_{11}} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$$

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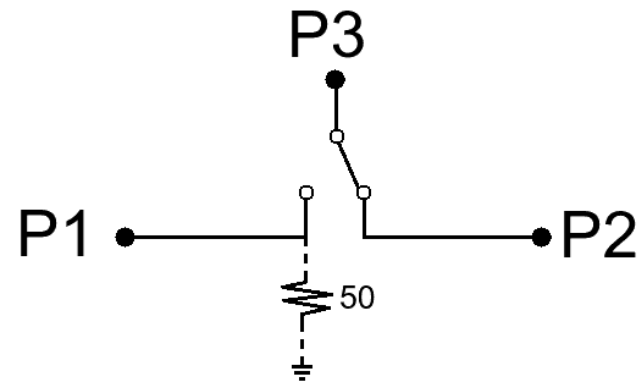
S11



S33

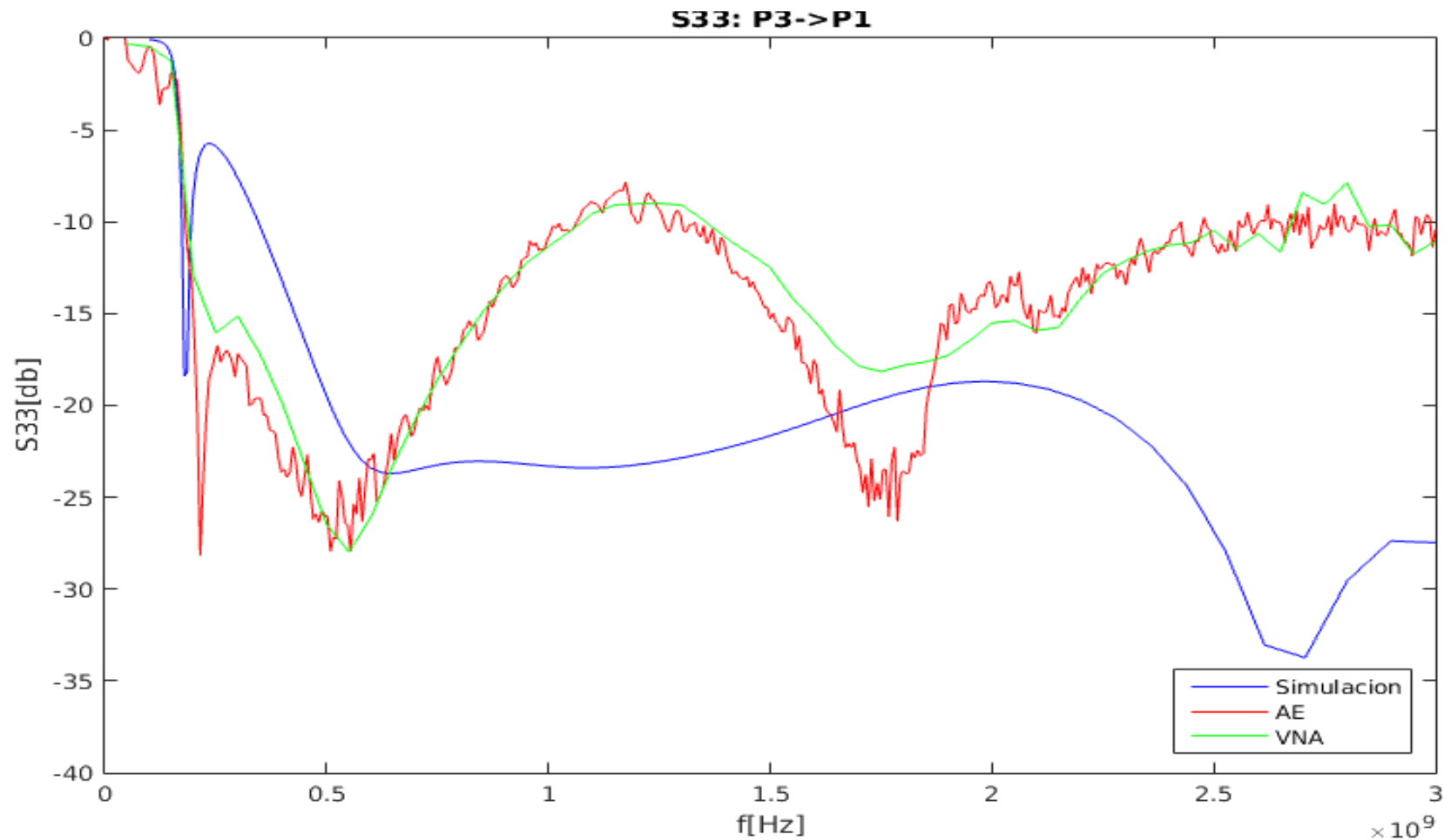


$$\overline{\mathbf{S}}_A = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & \textcircled{S_{33}} \end{bmatrix}$$

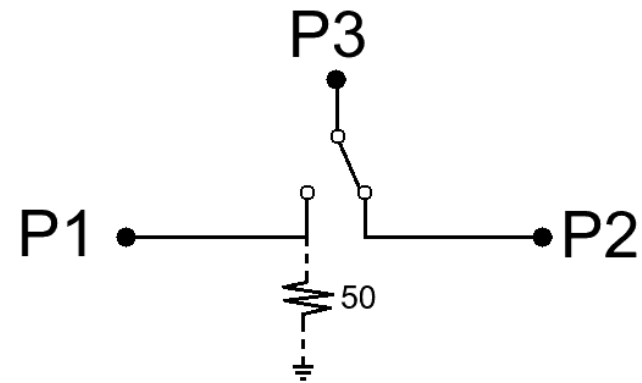
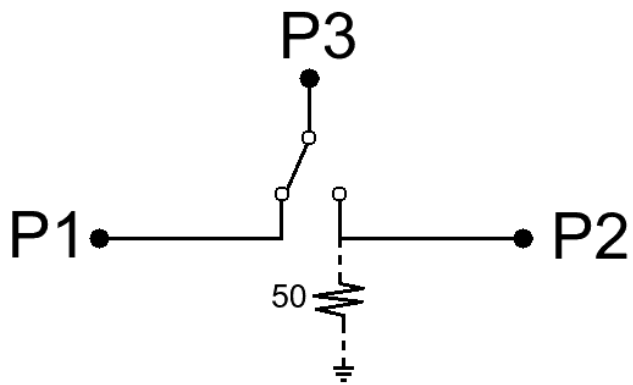


$$\overline{\mathbf{S}}_B = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & \textcircled{S_{33}} \end{bmatrix}$$

S33 - ambos casos



S31

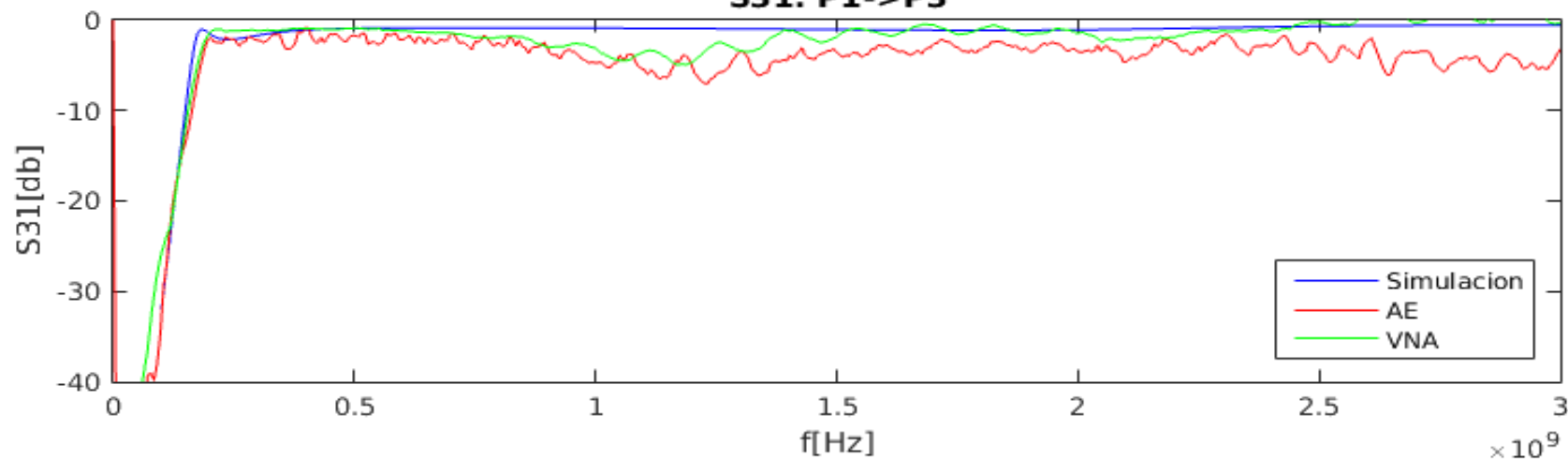


$$\overline{\mathbf{S}}_A = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ \textcircled{S_{31}} & S_{32} & S_{33} \end{bmatrix}$$

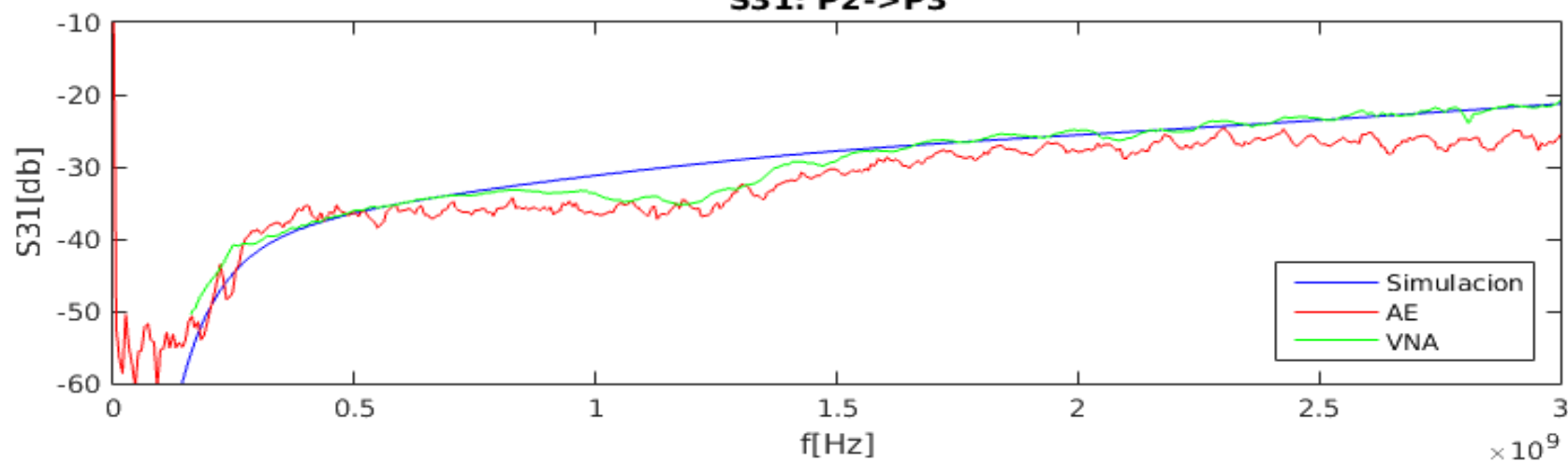
$$\overline{\mathbf{S}}_B = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ \textcircled{S_{31}} & S_{32} & S_{33} \end{bmatrix}$$

S31

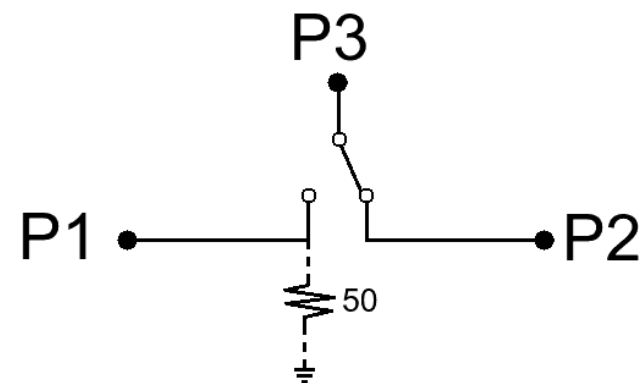
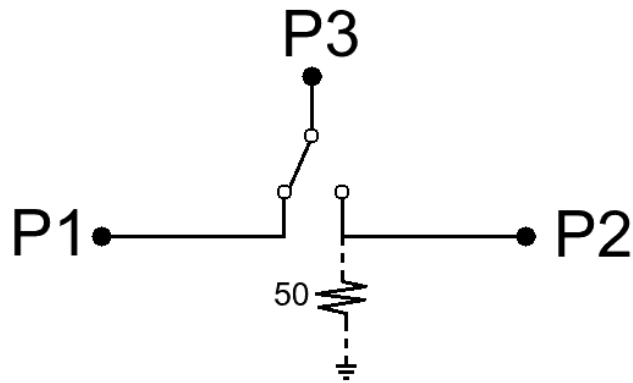
S31: P1->P3



S31: P2->P3



S21 - Ambos casos

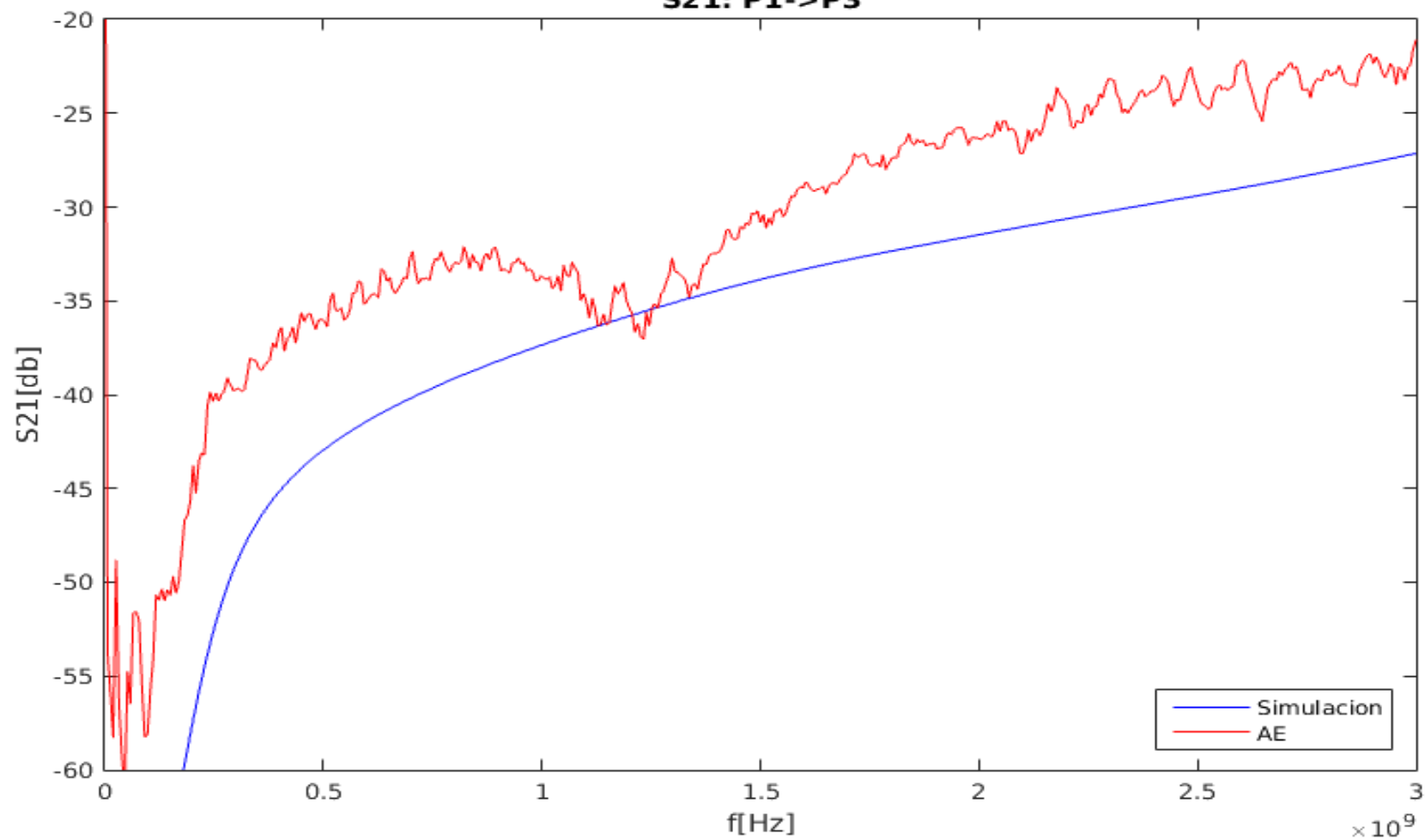


$$\overline{\mathbf{S}}_A = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$$

$$\overline{\mathbf{S}}_B = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$$

S21

S21: P1->P3



Resultados y Conclusiones

- El rango de trabajo es de 200Mhz a 3Ghz
- S_{11} máximo = -10dB
- S_{31} mínimo = -5dB (ON)
- Crosstalk máximo = -22 dB
- El circuito se comportó semejante a lo simulado
- Las alteraciones respecto a lo simulado corresponden a las capacidades parásitas de los componentes (Diodo Pin) y las desadaptaciones producidas por la placa.

Posibles mejoras del diseño

- Reducir la frecuencia de corte inferior.
- Lograr una mejor adaptación.
- Mejorar la placa de polarización.



Muchas Gracias

¿Preguntas?