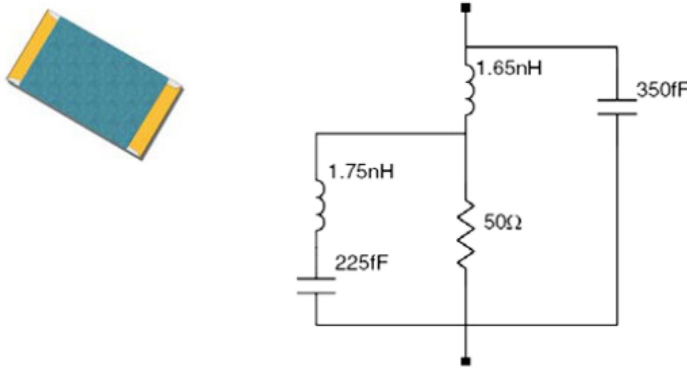
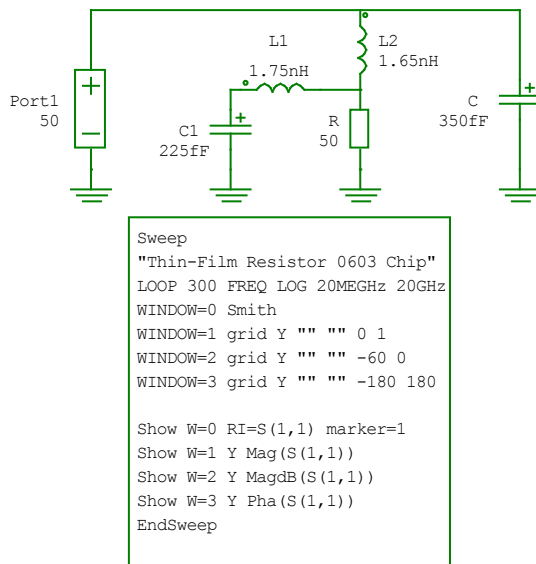


S-PARAMETERS OF A THIN-FILM RESISTOR

The thin-film chip resistor type 0603, illustrated below, can be modeled by the following equivalent lumped circuit,

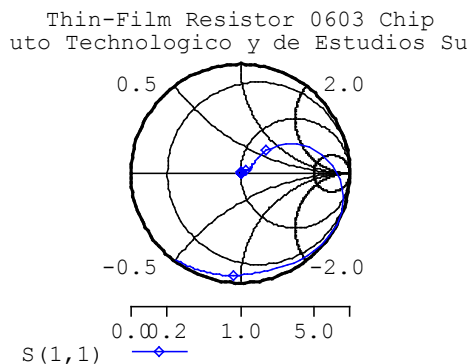
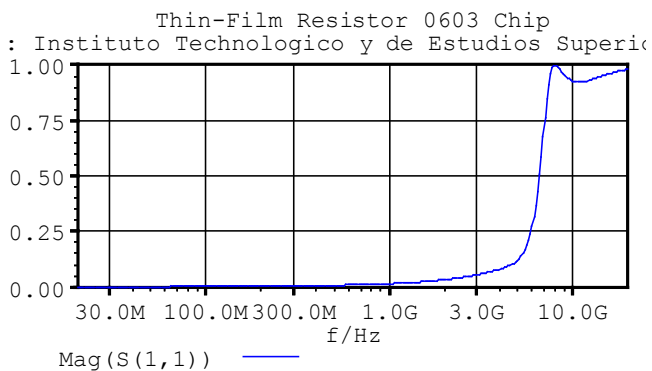


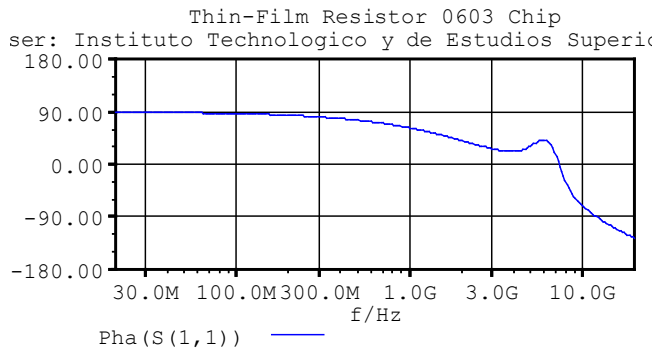
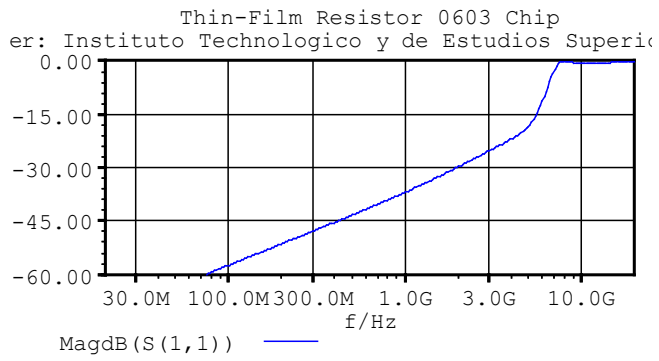
Define in APLAC the equivalent lumped circuit of the resistor as a one-port network, and obtain the magnitude (in dB) and phase (in degrees) of S_{11} , using a reference impedance of 50Ω , from 20MHz to 20GHz in logarithmic scale.



```

Res R nodel GND
+ 50
Cap C Port10 GND
+ 350fF
Ind L2 Port10 nodel
+ 1.65nH
Cap C1 node2 GND
+ 225fF
Ind L1 node2 nodel
+ 1.75nH
DefNPort nport 1
+ Port10 GND 50
Sweep "Thin-Film Resistor 0603 Chip"
+ LOOP 300 FREQ LOG 20MEGHZ 20GHZ
+ WINDOW=0 Smith
+ WINDOW=1 grid Y "" "" 0 1
+ WINDOW=2 grid Y "" "" -60 0
+ WINDOW=3 grid Y "" "" -180 180
Show W=0 RI=S(1,1) marker=1
Show W=1 Y Mag(S(1,1))
Show W=2 Y MagdB(S(1,1))
Show W=3 Y Pha(S(1,1))
EndSweep
    
```





Up to what frequency can this resistor be used as a good terminator? Which is the dominant behavior of the resistor (capacitive or inductive) at high frequencies? Why is the phase of S_{11} equal to 90° at low frequencies?