BPM processor simulation update

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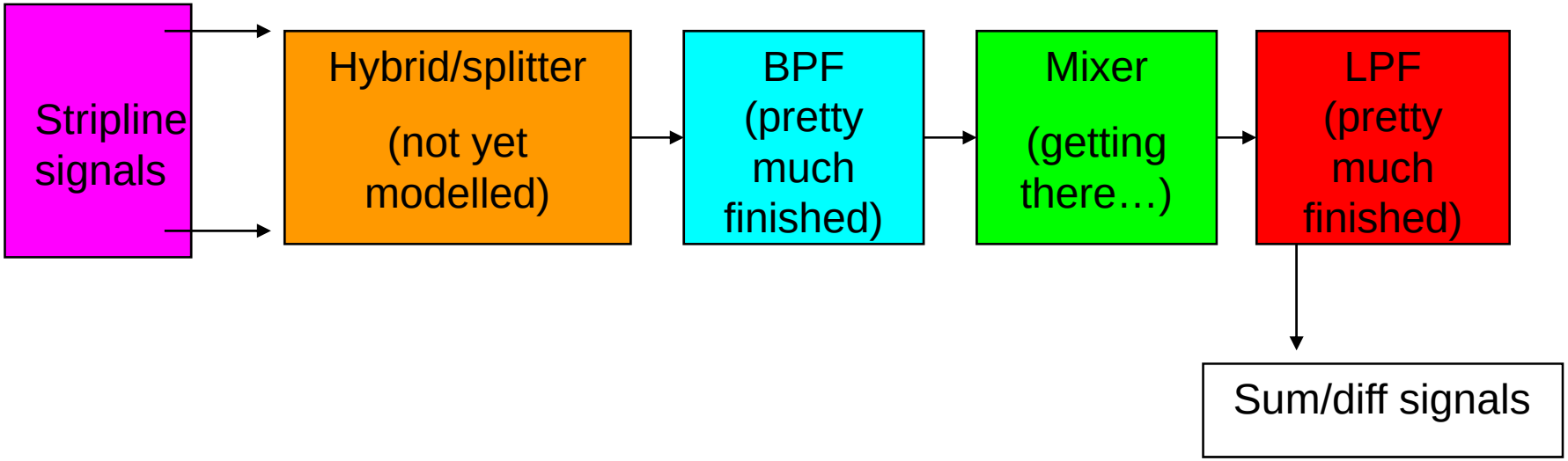
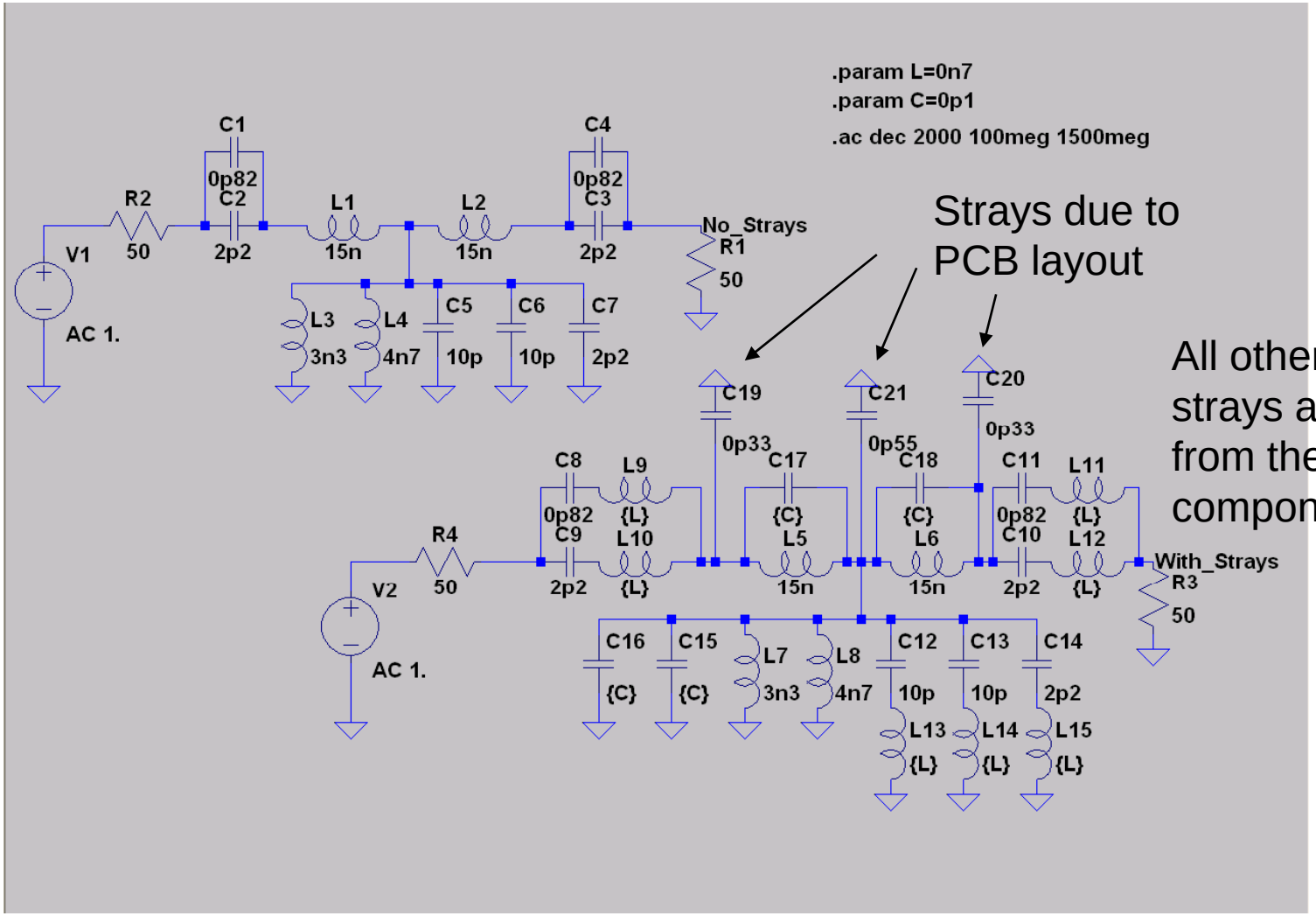
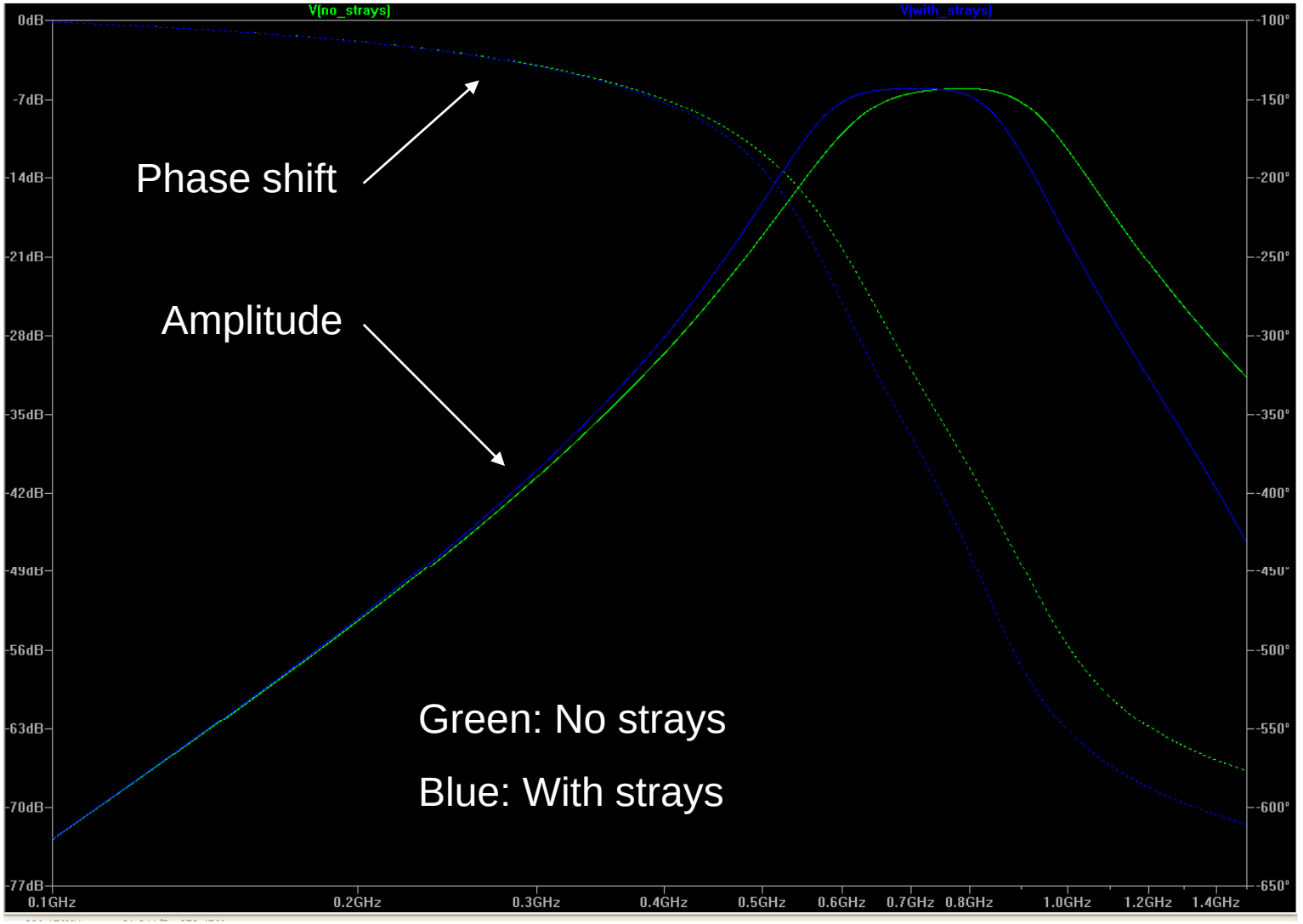
Basic processor layout



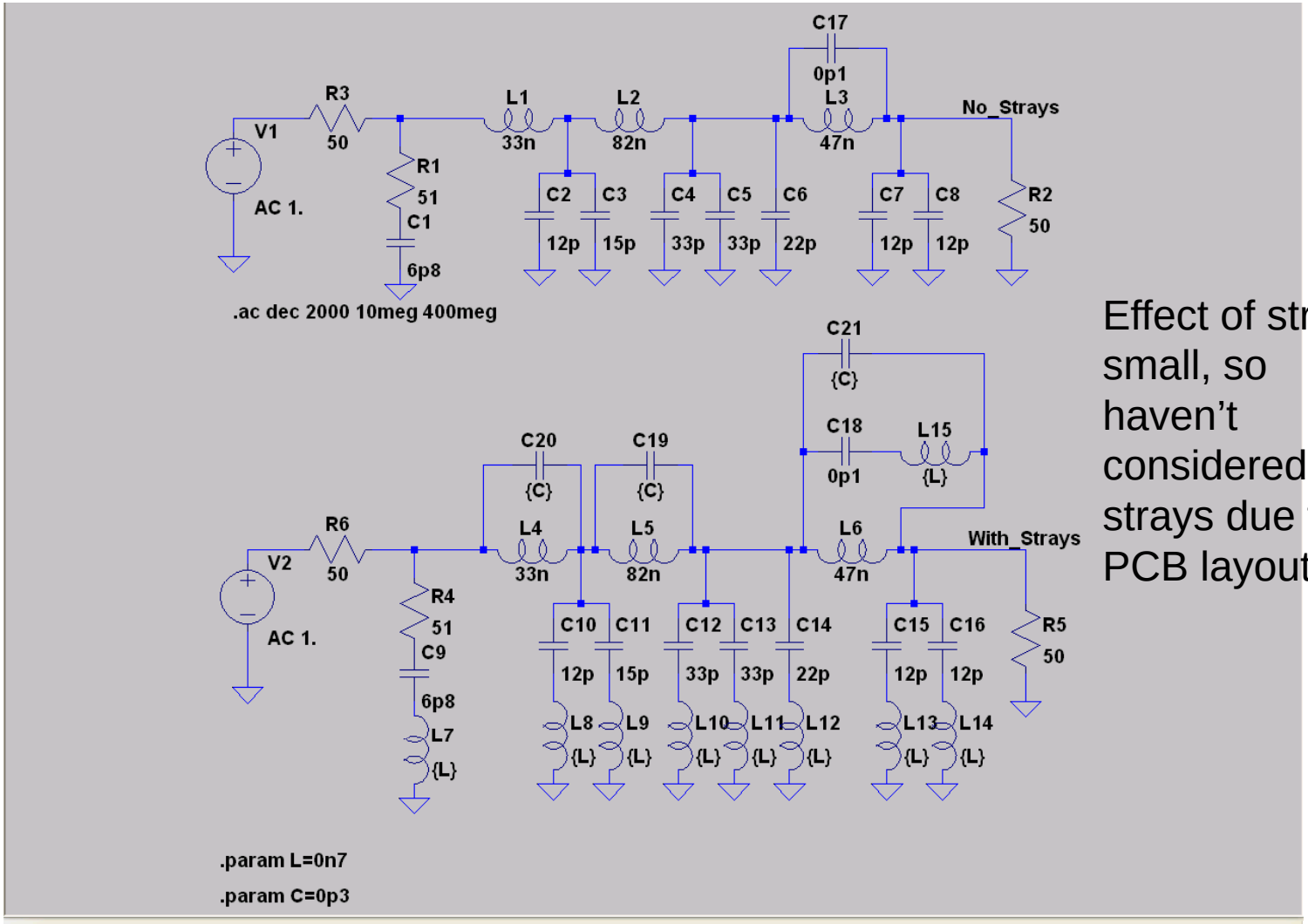
BPF


.param L=0n7
.param C=0p1
.ac dec 2000 100meg 1500meg
Strays due to PCB layout
All other strays are from the components
V1
AC 1.
R2
50
C1
0p82
C2
2p2
L1
15n
L2
15n
C4
0p82
C3
2p2
No_Strays
R1
50
L3
3n3
L4
4n7
C5
10p
C6
10p
C7
2p2
C19
0p33
C21
0p55
C20
0p33
C8
0p82
C9
2p2
L9
{L}
L10
{L}
C17
{C}
L5
15n
C18
{C}
L6
15n
C11
0p82
C10
2p2
L11
{L}
L12
{L}
With_Strays
R3
50
R4
50
V2
AC 1.
C16
{C}
C15
{C}
L7
3n3
L8
4n7
C12
10p
C13
10p
C14
2p2
L13
{L}
L14
{L}
L15
{L}

BPF

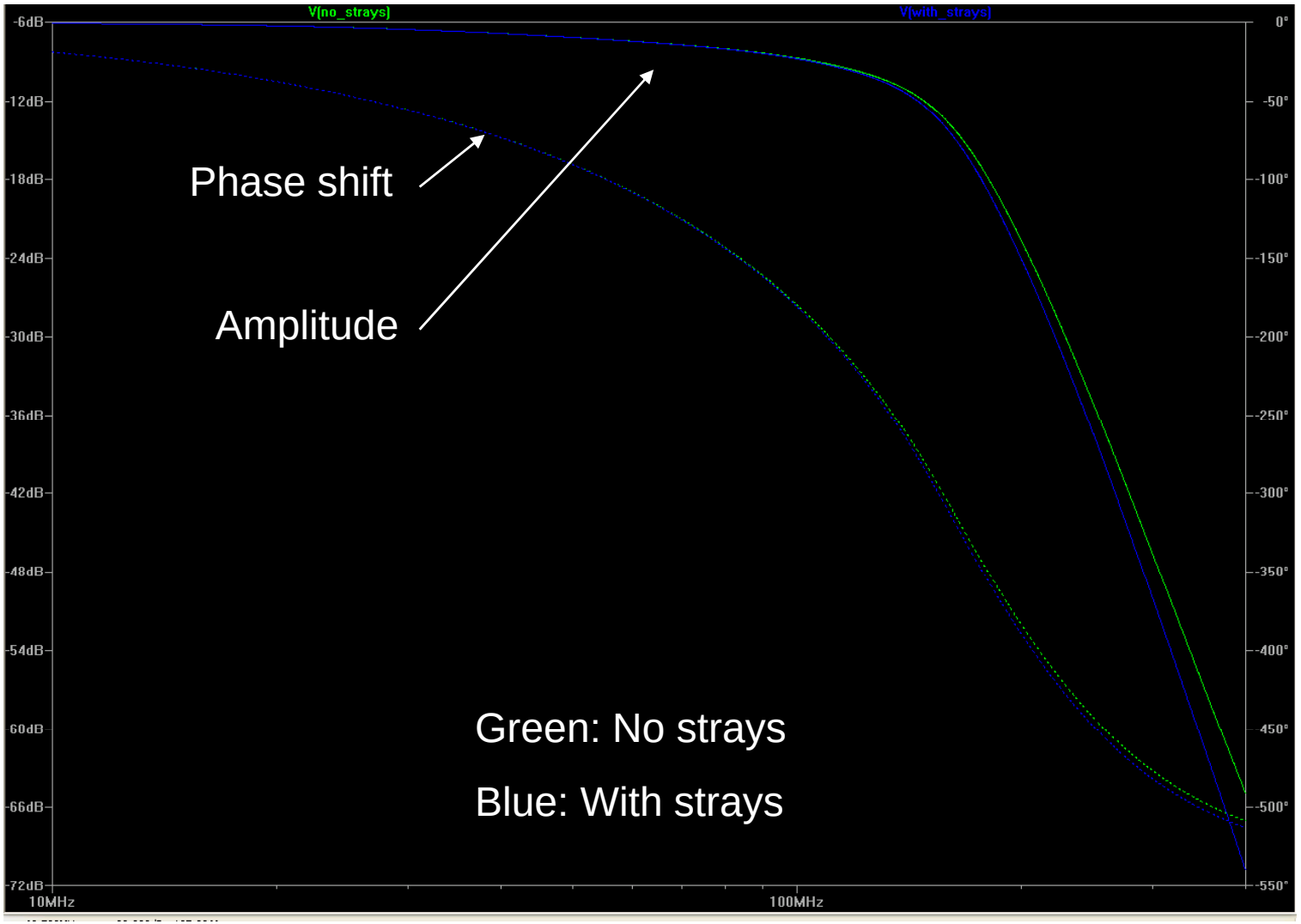

V(no_strays)
V(with_strays)
0dB
-7dB
-14dB
-21dB
-28dB
-35dB
-42dB
-49dB
-56dB
-63dB
-70dB
-77dB
-100°
-150°
-200°
-250°
-300°
-350°
-400°
-450°
-500°
-550°
-600°
-650°
0.1GHz
0.2GHz
0.3GHz
0.4GHz
0.5GHz
0.6GHz
0.7GHz
0.8GHz
1.0GHz
1.2GHz
1.4GHz
Phase shift
Amplitude
Green: No strays
Blue: With strays

LPF



Effect of strays small, so haven't considered strays due to PCB layout

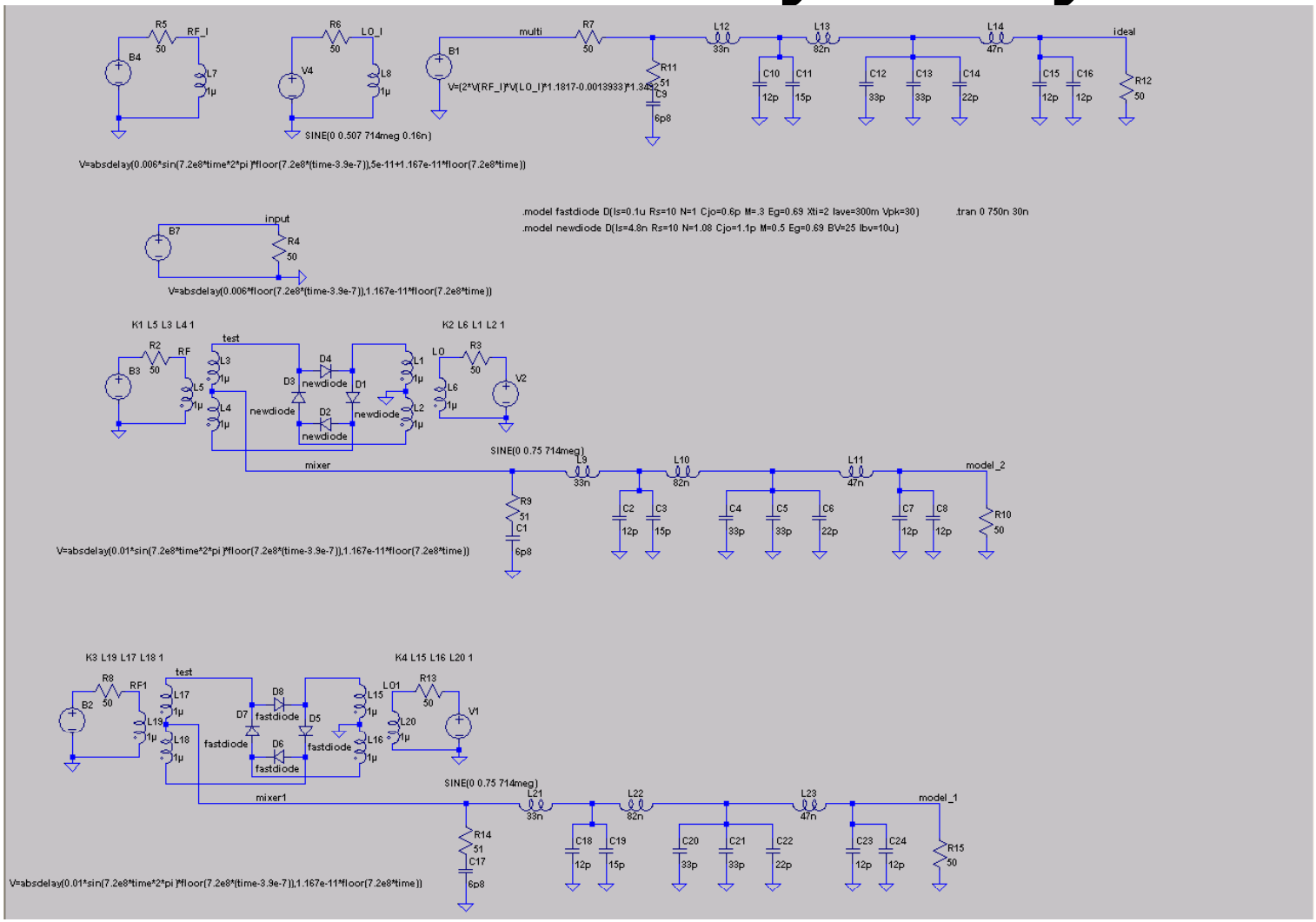
LPF


V(no_strays)
V(with_strays)
-6dB
-12dB
-18dB
-24dB
-30dB
-36dB
-42dB
-48dB
-54dB
-60dB
-66dB
-72dB
0°
-50°
-100°
-150°
-200°
-250°
-300°
-350°
-400°
-450°
-500°
-550°
10MHz
100MHz
Phase shift
Amplitude
Green: No strays
Blue: With strays

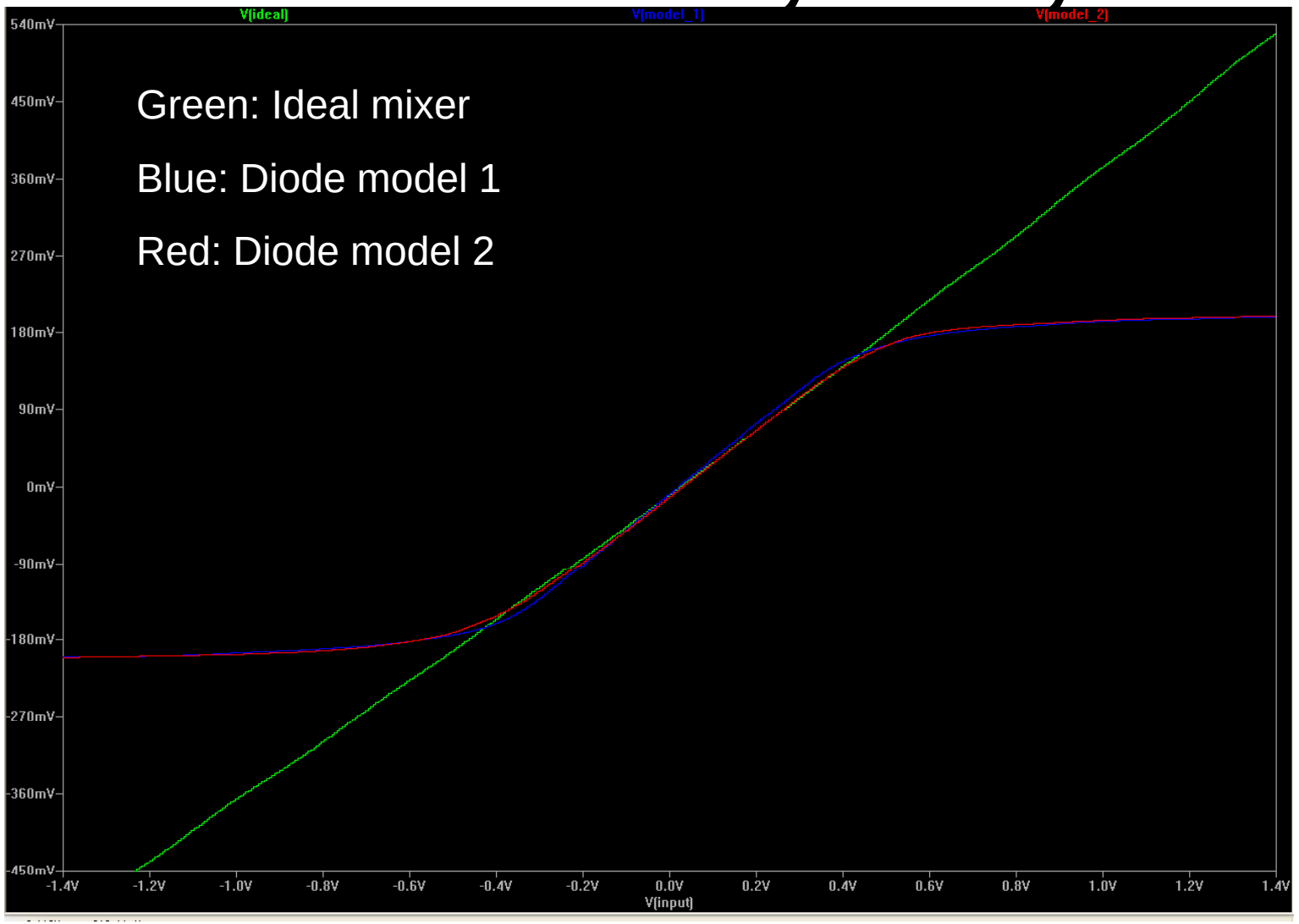
Mixer-linearity study

- Plotted RF input amplitude vs. mixer output amplitude for 2 diode models and an “ideal” mixer
- Ideal mixer is RF signal multiplied by LO signal

Mixer-linearity study



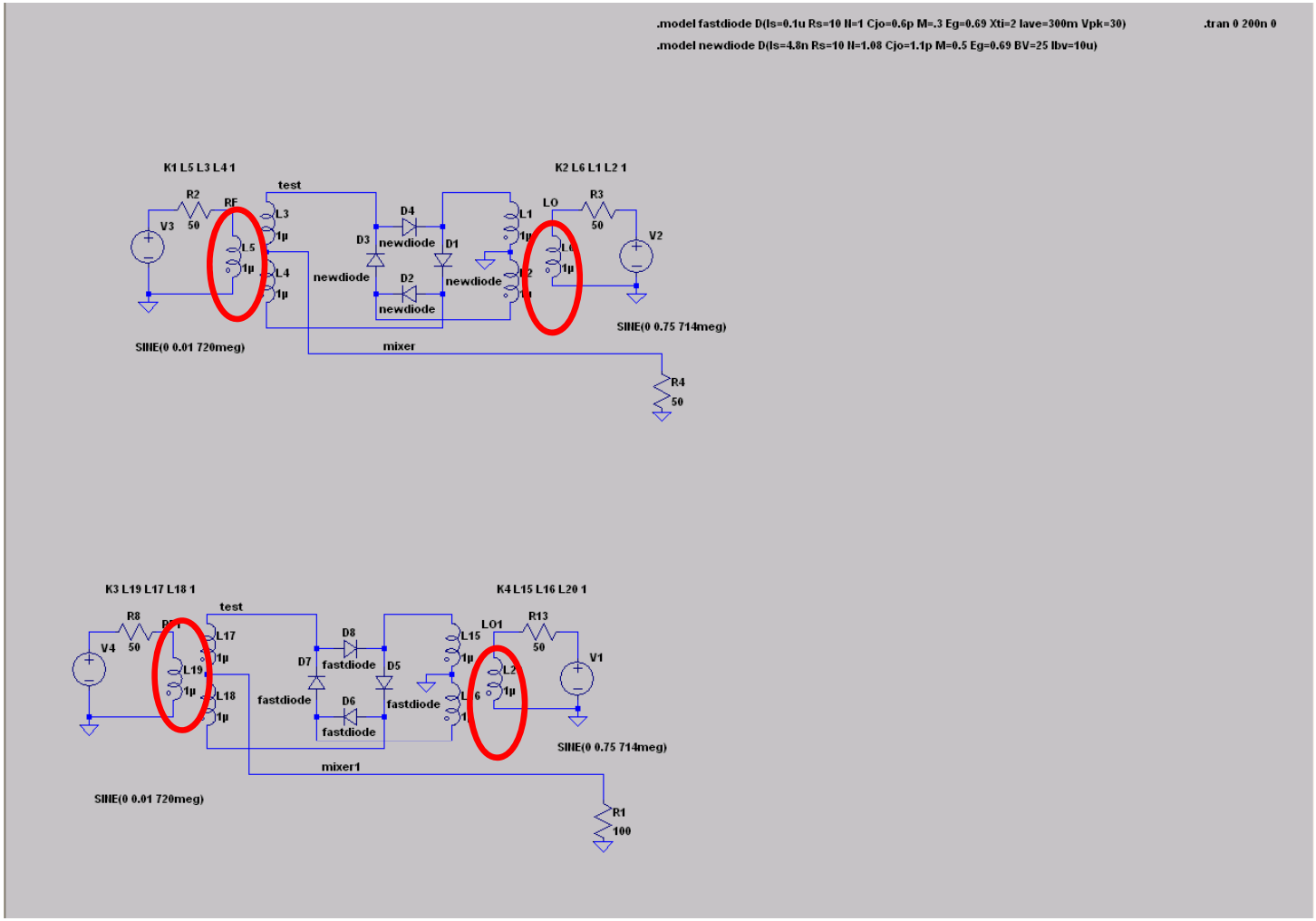
Mixer-linearity study



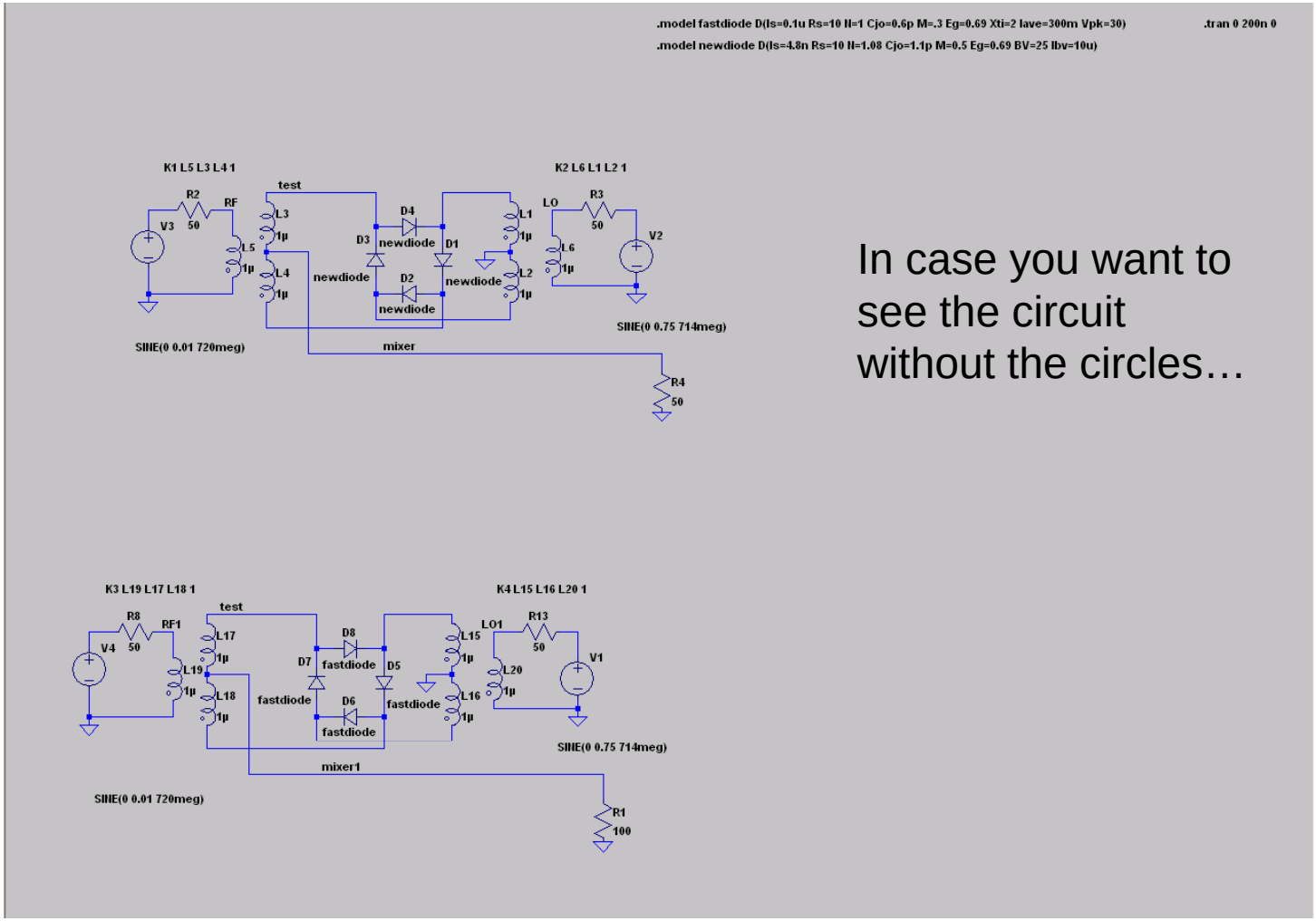
Mixer-impedance study

- Input impedance
  - Divide voltage across input inductor by current passing through it for RF and LO ports
  - Measured input impedance for both maximum and minimum voltage and current for the two diode models, as shown on next slides…

Mixer-impedance study

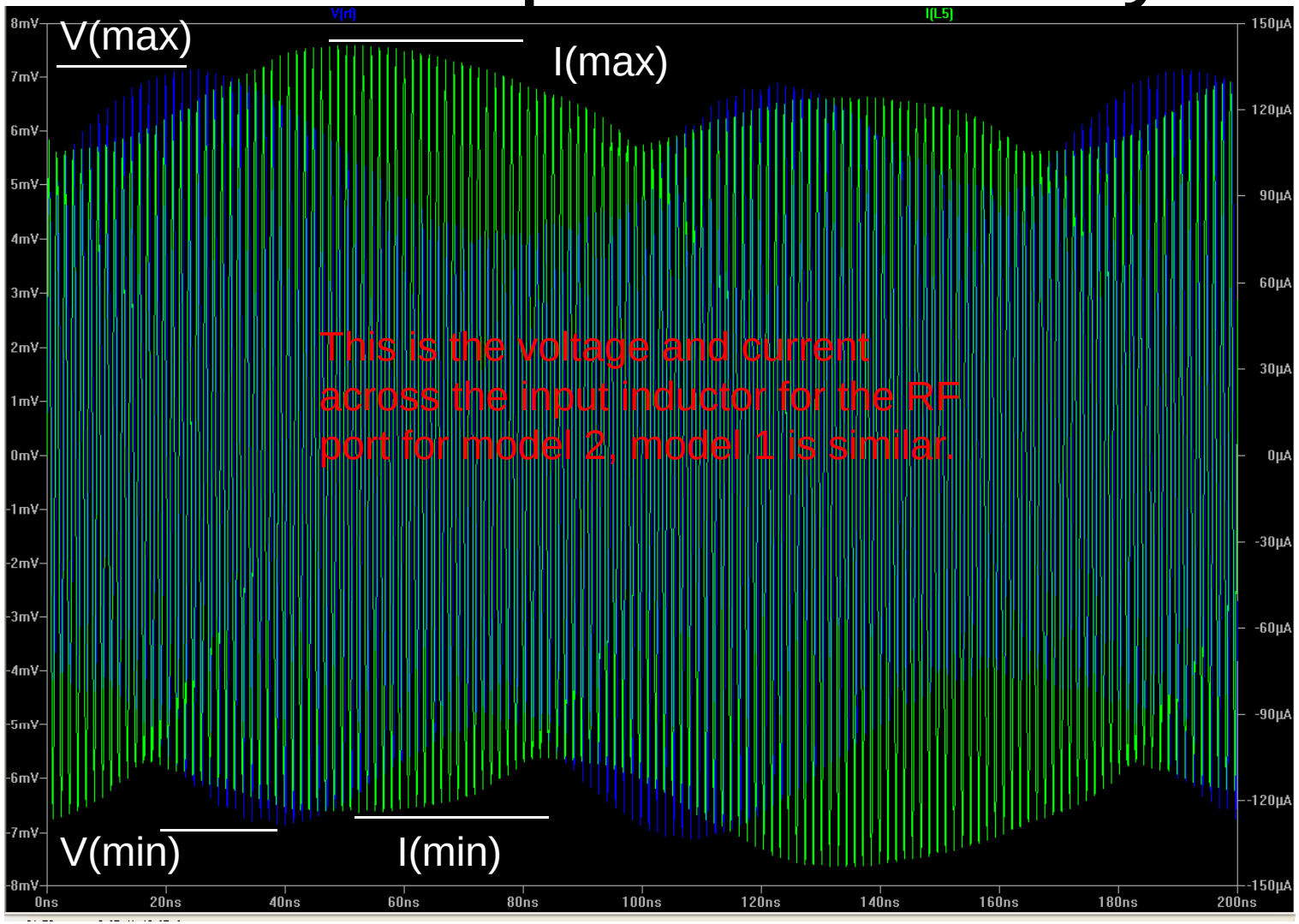


Mixer-impedance study

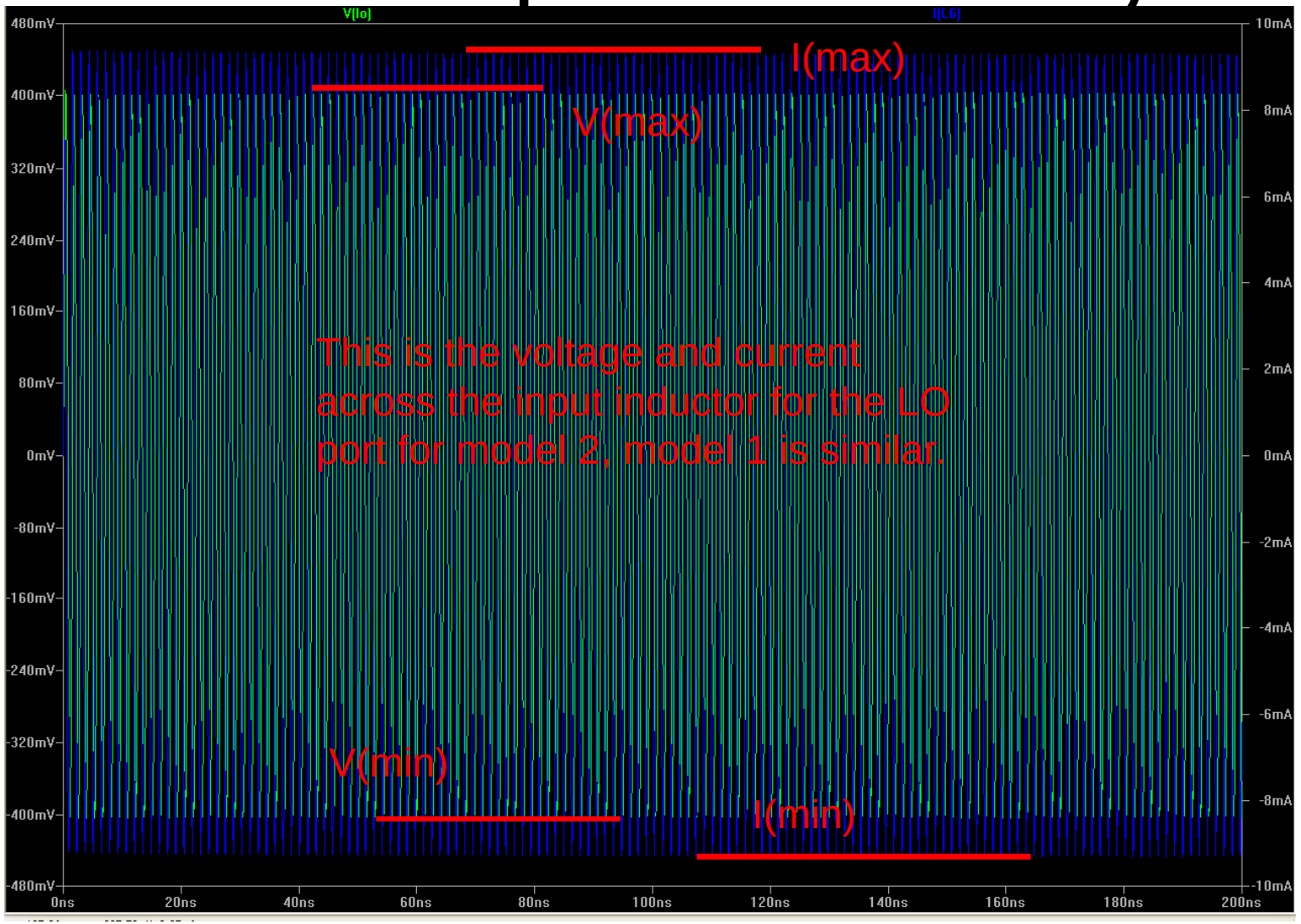


In case you want to see the circuit without the circles…

Mixer-impedance study



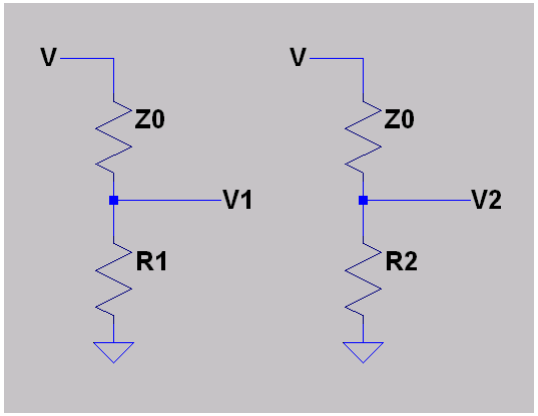
Mixer-impedance study



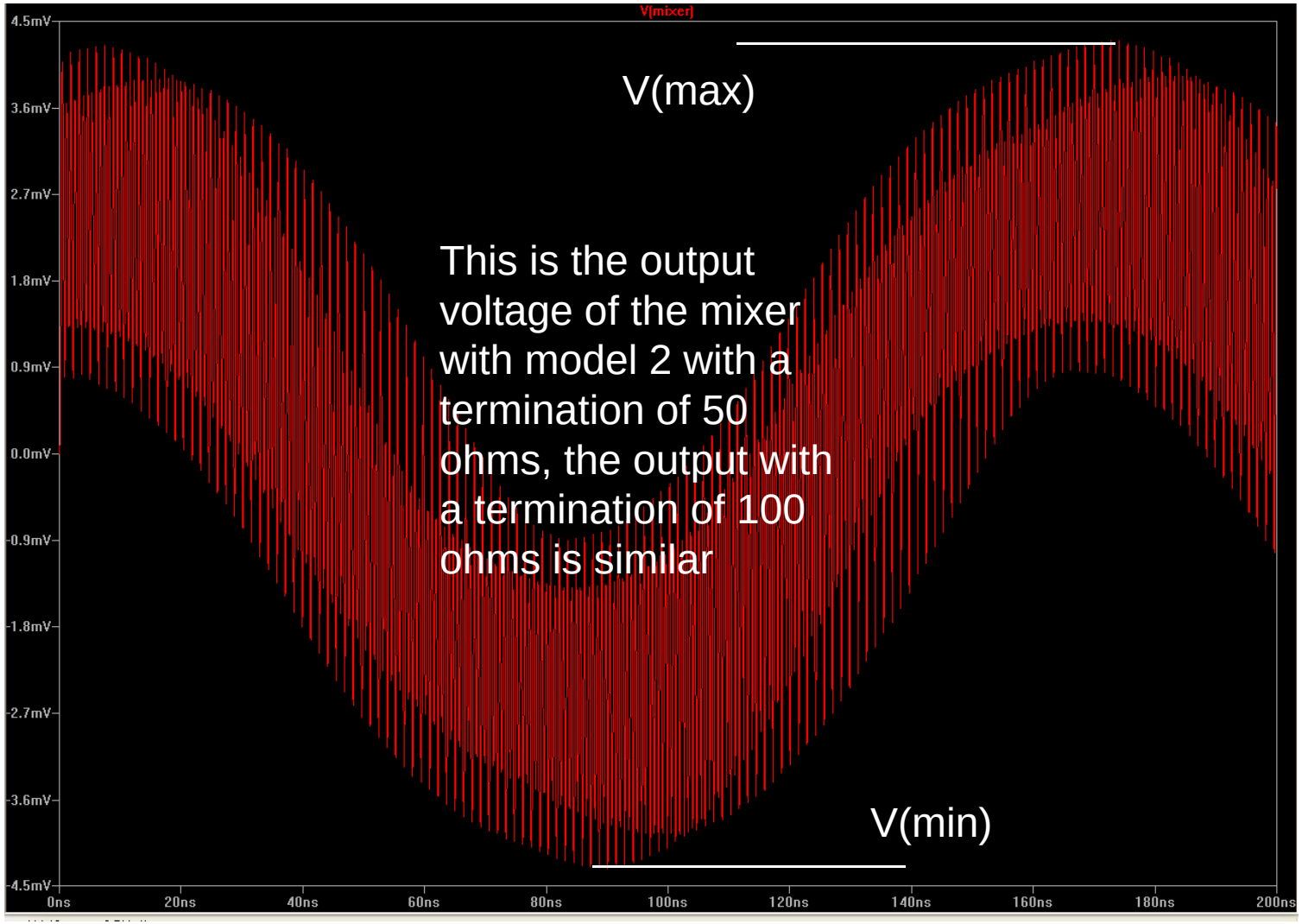
Mixer-impedance study

- Output impedance
  - Assume mixer is a device with some impedance across is (maybe too simple…)
  - By measuring output voltage across 2 different termination impedances, one can determine Z0.

$$Z_0 = \frac{R_1 R_2 (V_2 - V_1)}{V_1 R_2 - V_2 R_1}$$



Mixer-impedance study



Mixer-impedance study

- VSWR = Z0/ZL
- The following results should be taken with a rather large pinch of salt…

Impedance measurements

	Input impedance RF		Input impedance LO		Output impedance		VSWR RF		VSWR LO	
	max	min	max	min	max	min	max	min	max	min
Model 1	61.56	58.57	36.02	37.19	30.53	29.28	2.016	2	1.18	1.27
Model 2	49.94	55.63	42.93	43.54	16.14	15.78	3.094	3.525	2.66	2.76
Data sheet	~50		~50		~50		1.34 - 1.4		2.04 - 2.13	

Max and min mean that the impedance or VSWR were calculated using either V(max)/V(min) and I(max)/I(min)