Design of a Class-A Power Amplifier

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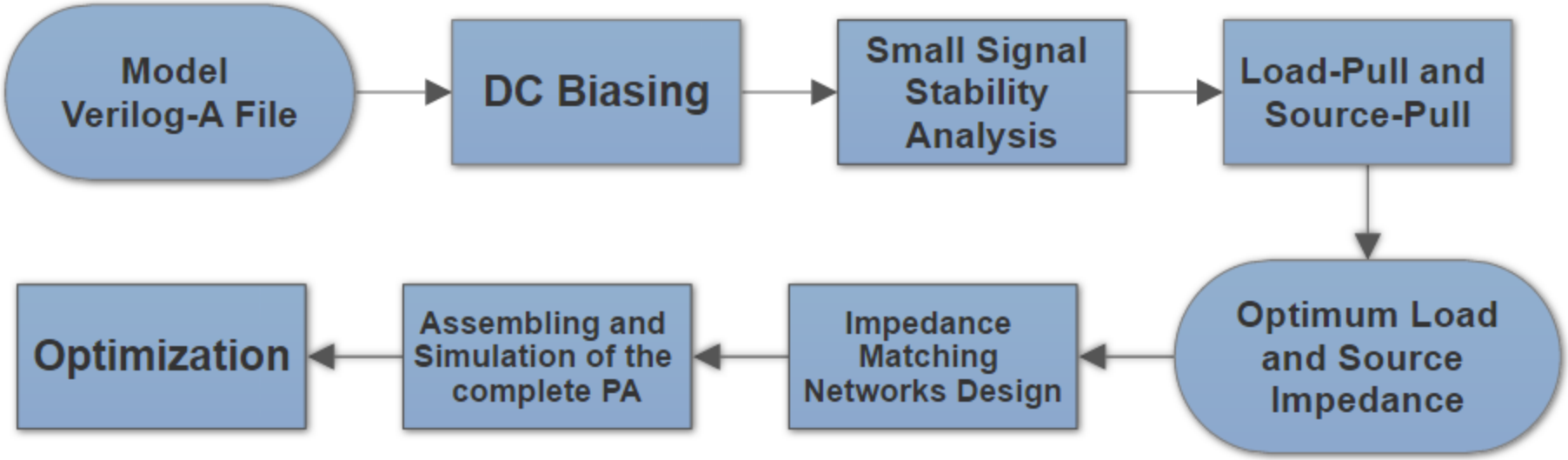
RF Power Amplifiers

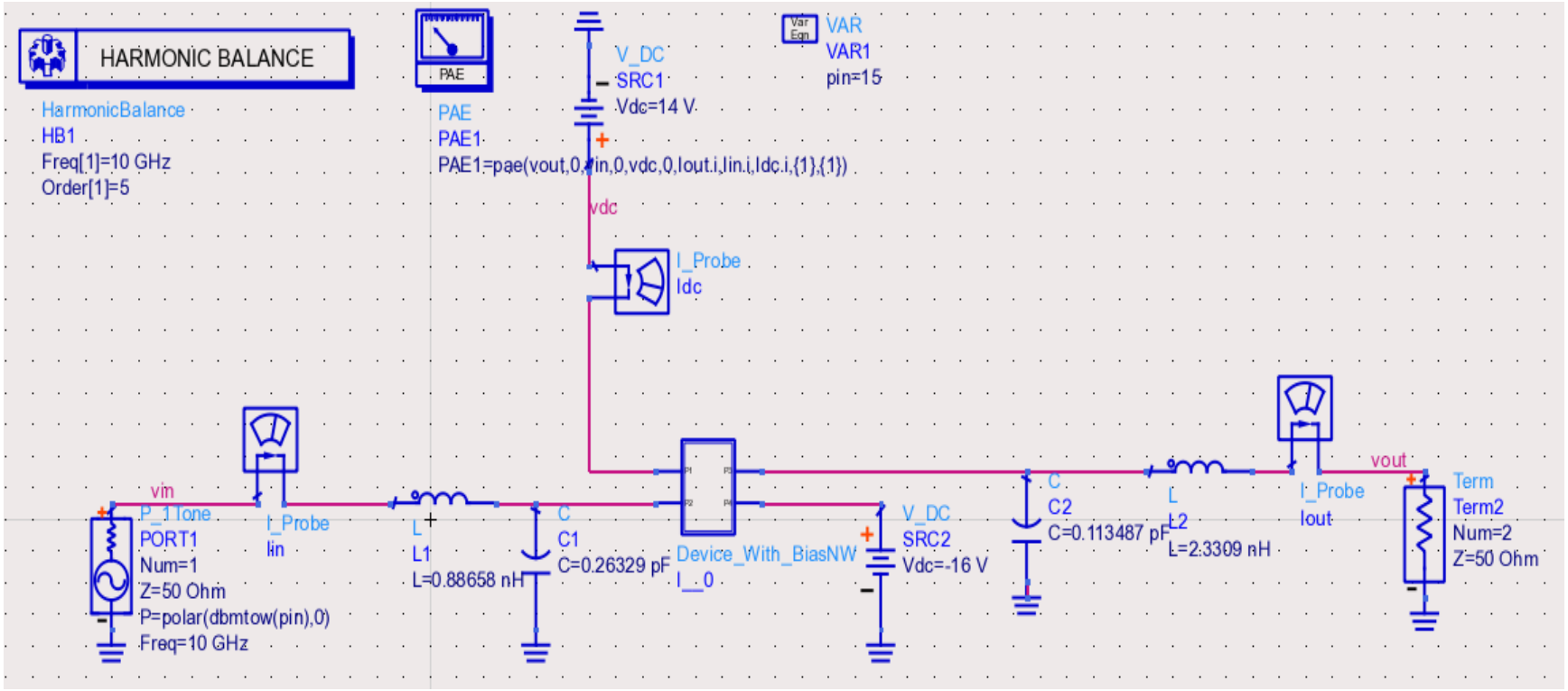
- A power amplifier, as the name implies, is not just intended to amplify a signal, but to also have that signal provide significant power.
- A simple amp might take a 1 mV microphone signal and make a 1 V "line" signal. It provides substantial voltage gain. Another amp might take that 1 V signal and make a 10 V signal that can drive a loudspeaker load. That is only a voltage gain of 10, but that signal has been able to provide significant output power.
- They are used in a wide variety of applications including Wireless Communication, TV transmissions, Radar, etc.

Flowchart of the Design Process

I aim to design a **10GHz Class-A Power Amplifier** using the **MVSG-RF Model**. (Ref. 1)
Following flowchart establishes the steps to be followed to do the same.

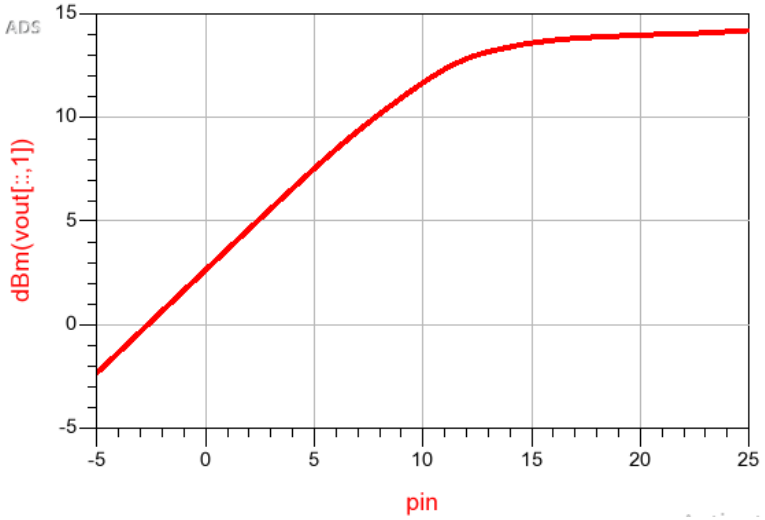


Assembling and Simulation of the complete Power Amplifier



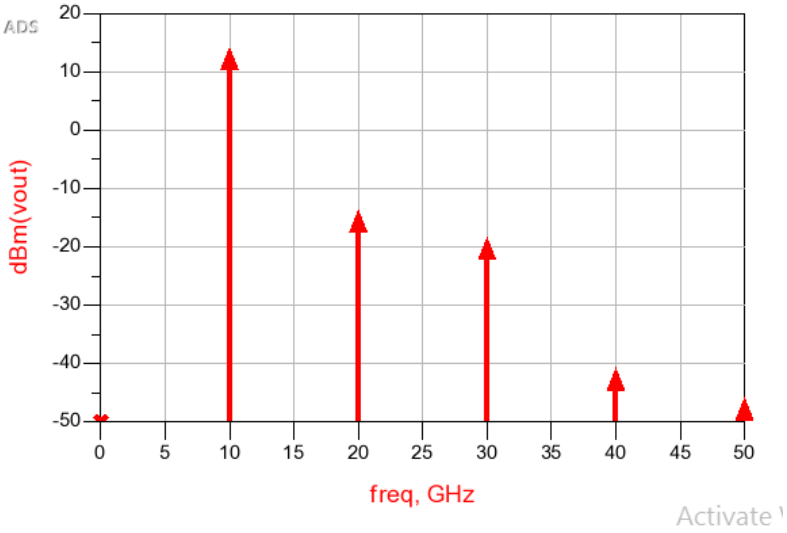
The Device with Biasing Network is assembled with both the impedance matching networks and various probe components. On performing Harmonic balance simulations, the output power in dBm of various harmonics and the P_{OUT} vs P_{IN} graphs were obtained, which are displayed on the next slide.

Performance of the Power Amplifier

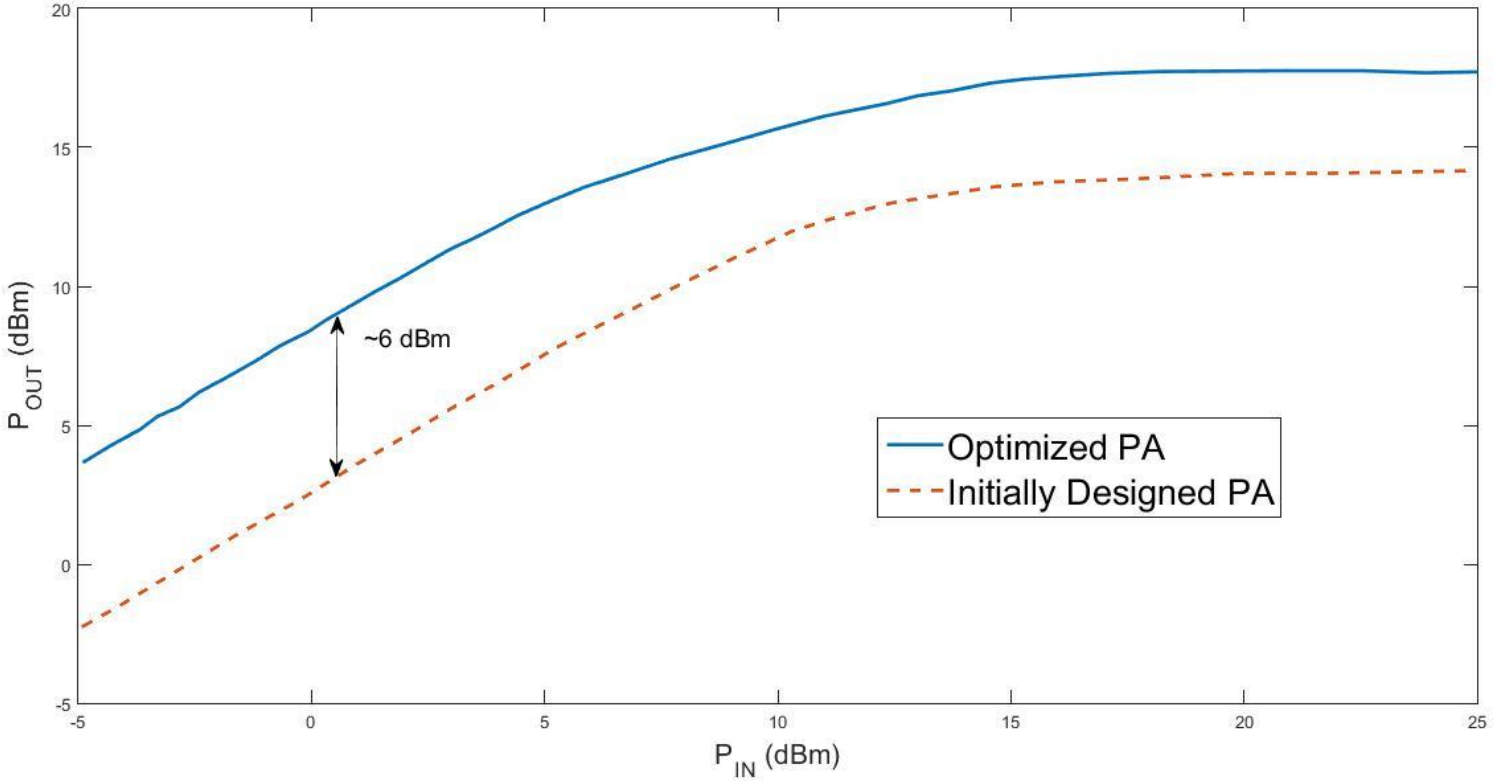


The P_{OUT} vs P_{IN} graph saturates at about 13 dBm of input power and provides a gain of about 1.5 dBm at 10 dBm of input power.

From the HB Simulations, it is found that the output harmonics at 15dBm of input power are distributed as follows:
Fundamental : 14.8 dBm
2^{nd} Harmonic : -15 dBm
3^{rd} Harmonic : -19 dBm
and so on.



Optimization - Impact of Circuit-Level Modifications



There is a significant improvement of 6 dBm in gain by optimization of the circuit. Now, **Device Parameter modifications** are carried out and their impact on performance noted.

Thank you !