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Research/Master Thesis

RF

Load Pull simulation of Mixers and design of a IF Buffer Amplifier for improved Mixer performance

Motivation:

A key component for designing transceivers is the mixer. Usually the IF port of a mixer is directly feed off chip into the modem. This leads to some disadvantages like the direct connection to a fixed 50 Ohm load. Therefor the mixers IF port needs to be directly matched to 50 Ohm what can be difficult for a broadband IF signal. Also the optimum load for the mixers IF port usually differs from 50 Ohm, but matching might be difficult using passive components. Another disadvantage of the direct connection to off-chip environment can be possible power fluctuations, which might be harmful for the mixer. This could be improved by using an additional IF buffer amplifier. This buffer could protect the mixer and pre amplify the IF signal. Another benefit of the buffer is the possibility of matching the IF port to an optimum load according to load-pull theory. Usually load- and source-pull measurement or simulation are used to improve amplifier performance. This can also be done for frequency converting devices like mixers. Therefore based on load and source pull measurements and simulations and the design of an additional IF buffer amplifier can be used to improve mixer performance.

Goals:

- Design of a broadband Transceiver consisting of broadband components
- Bandwidths of up to 100 GHz
  - IF…>0 GHz – 90 GHz
  - RF…250 GHz-350 GHz
  - LO…240 GHz – 260 GHz
  - Balanced amplifier

Tasks:

- Investigation of load-pull measurements and simulations of frequency converting devices
- Performing Load-pull simulations on a existing mixer (the IF-ports of the mixers should be investigated).
- Design of an IF buffer amplifier according to the previous performed measurement/simulation for improved mixer behavior
  - Design in Keysight advanced design systems and RFpro
- Design in the Fraunhofer IAF 35nm mHEMT technology