X-band active balun MMIC in SiGe technology

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Baluns are used to transform an unbalanced input signal into a balanced output signal. Baluns are essential components in many microwave circuits, e.g., balanced mixers, or other differential architectures. When the signal is received by the antenna, it is single ended, and thus need to be converted to a balanced signal to benefit from a differential system architecture. Being first in the receiver chain, having a passive balun, will degrade the noise figure significant, thus it is beneficial to have low noise amplifier, which behaves as a balun. For the receiver to have a large dynamic range this balun must also have good linearity, and a high compression point (D. Manstretta, *IEEE JOURNAL OF SOLID-STATE CIRCUITS*, **47**, 2012, pp. 407-420).

We present an active balun, optimized for large dynamic range, integrated in a SiGe process. This allows for later integration into a full single MMIC receiver circuit. The design uses a differential cascode amplifier as the core circuit topology. The input is matched using a series inductor and a decoupling capacitor together with a shunted capacitor. The other input branch is shorted through a decoupling capacitor. This allows easy biasing of the transistors. The high common mode rejection ratio of the amplifier, gives the balun performance. The output is matched, using a RF shorted inductor, which also serves for biasing, and a series capacitor, which also decouples the output. Figure 1 shows the layout of the circuit.

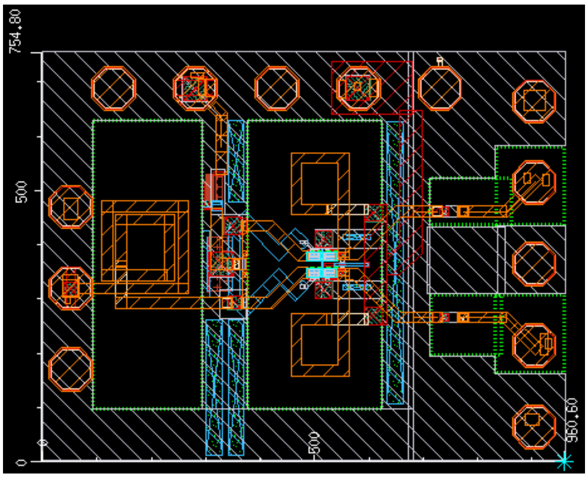

Figure 1 Layout of active balun circuit. Circuit size is 755µm × 960µm

Thorough EM-simulations is made and coupled together with S-parameter and Harmonic balance simulations to give a realistic impression of the circuit before manufacturing. These predict a gain of 16.3 dB at the center frequency of 10.5 GHz, with a 3-dB bandwidth from 10 GHz to 11 GHz. At the center frequency the return loss is 24 dB and the noise figure is 4.8 dB. The phase mismatch is predicted to be below 3 degrees and the magnitude mismatch below 1.5 dB. The input referred 1dB compression point ($P_{in,1dB}$) is -6 dBm and third order input intercept point (IIP3) is 12.6 dBm. The circuit is currently being manufactured, and experimental results will be presented at the meeting.