HEMT Based Oscillator for Wireless Applications

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***Abstract*— This project work reports the design, analysis and development of HEMT based oscillator at 2.4 GHz for wireless applications. Agilent Advanced Design System (ADS) in conjunction with Electro Magnetic Design Simulation (EMDS) tool is used to predict the performance of designed oscillator. The measured characteristics of the oscillator are output power of 9.25 dBm and phase noise of -123 dBc/Hz at 1 MHz offset which are similar to the designed one.**

Concept

There has been revolutionized for multi-band and multi-standard transceiver architectures in the field of wireless communications. It is possible to make tunable oscillator using electronically tunable resonators or using varactor diode at the input and wideband output matching circuit at the output using single transistor. Method of negative resistance has been used for design of oscillator in this work as shown in fig 1. We will restrict to fixed frequency oscillator for our design.

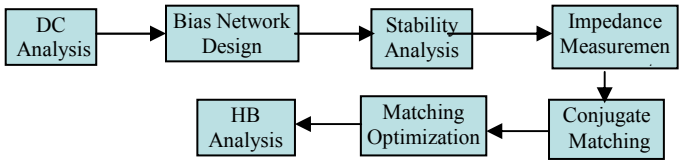

Fig. 1. Design steps followed for the Oscillator

Simulation and Fabricated circuit

Harmonic balance analysis is carried out using ADS in conjunction with electromagnetic design simulation tool momentum to determine full wave analysis and the frequency of oscillation, output power and phase noise of this oscillator as shown in fig 2.

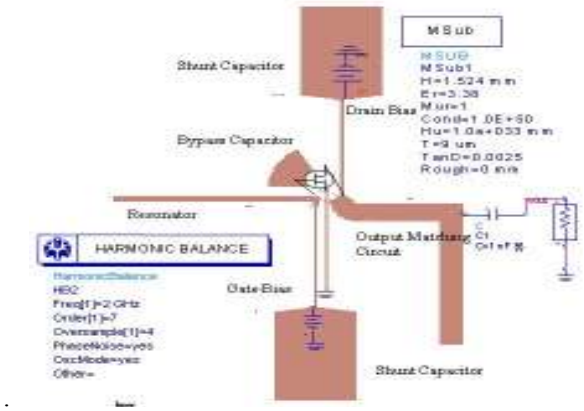

Fig. 2 Simulated layout of fixed frequency oscillator

The designed layout was fabricated on NH9338 substrate having εr =3.38, dielectric thickness of 1.524 mm, copper thickness of 9μm and dissipation factor of 0.0025 as shown in Fig 4.

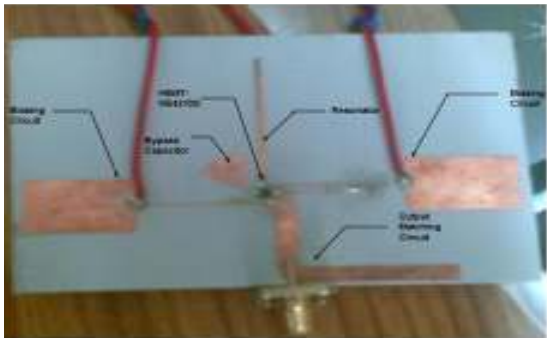

Fig. 3. Hardware circuit of fixed frequency oscillator

Simulated and Measured Results

The oscillator has simulated value of output power of 5.11 dBm and phase noise of -131 dBc/Hz at 1 MHz offset (Biasing circuit Vds = 2V and Vgs = -0.69 V) as shown in fig 4.

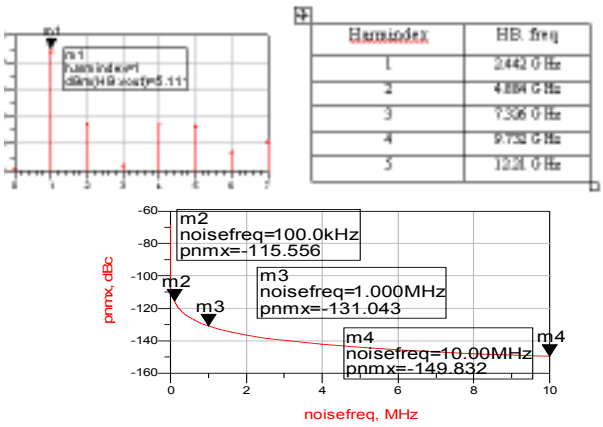

Fig. 4. Simulated result of output power and phase noise

The designed circuit is developed and characteristics are measured and results are shown in fig 5. The fundamental frequency of the circuit is 2.502 GHz and first harmonics is 9.25 dBm and second harmonic is 2.79 dBm.

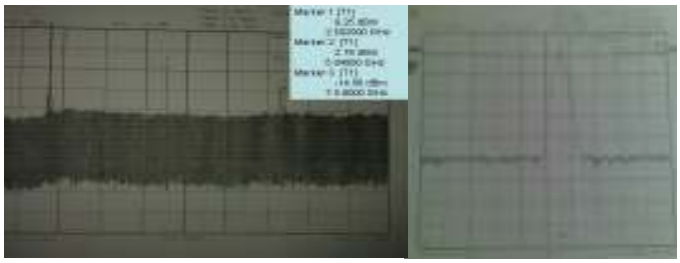

Fig. 5. Measured results of fixed frequency oscillator

Conclusion

Nonlinear analysis of HEMT based Oscillator has been carried out. Full wave nonlinear analysis method can be used to design and accurately predict the behavior of active integrated circuit Oscillator. This design provides many advantages, including simplified analog circuitry, low supply voltage, low power consumption, high power output.