

GaN HEMT based oscillators

Using GaN HEMT technology in oscillator applications has potential advantages due to the high breakdown voltage and high frequency properties. High voltage swing can be utilized for increased dynamics and thus lower phase noise which is the most critical parameter in a point-to-point communication system. Moreover, the robust properties of the GaN HEMT make it highly interesting for circuits in satellite communication.

Results from GHz Centre show that GaN are promising for these applications. Outstanding performance is reached for an oscillator module based on a high-Q cavity and a GaN MMIC amplifier.

Partners in GHz Centre Stage 3 (2012-2014):

Chalmers, Ericsson, Ruag Space

An ultra low phase noise 12GHz cavity oscillator based on a GaN HEMT device

Mikael Herberg, Thomas Emanuelsson, Herbert Zirath, Dan Kuylenstierna

Abstract—This paper reports on a 12GHz GaN HEMT oscillator, based on a MMIC reflection amplifier and an aluminum cavity resonator. The reflection amplifier is connected with bondwires to a microstrip line on PCB that couples to the cavity. An unloaded quality factor of 2500 is measured for the cavity. The oscillator's phase conditions can be controlled by moving the cavity along the microstrip line and the coupling factor between resonator and cavity can be changed by moving the cavity

of a metal cavity can be very cost-effective as it can be integrated in the shielding enclosure for the module where the oscillator is used. Further, MEMS structures for frequency tuning can be integrated in the metal cavity [9].

II. THEORY, DESIGN AND SIMULATIONS

Oscillator phase noise at offset f_m can be quantitatively modeled by Leeson's equation [2],

Low Phase Noise GaN HEMT Oscillators With Excellent Figures of Merit

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Abstract—This letter presents guidelines for the design of low phase noise oscillators in GaN high electron mobility transistor (HEMT) technology. The design starts from the definition of the frequency of operation, the oscillator topology and the point on the device for operation frequency where it will be used. The best HEMT noise properties are obtained for low drain voltage and current. Thus, the low phase noise can be achieved at low dc power which also means that power integrated phase noise figure of merit (PFOM) will be good.

Two different oscillators have been designed and measured. A 9.9 GHz common-gate balanced Colpitts oscillator operating in class C presents a phase noise of -138 dBc/Hz @ 1 MHz. The results are achieved for $V_{ds} = 6$ V and $I_{ds} = 20$ mA, giving PFOM =

II. GaN HEMT LOW PHASE NOISE

