

## Project 5.

### Monofrequency transistor oscillator

*This project is focused on the small-signal design of a monofrequency transistor oscillator with a microstrip resonator, bias circuits and a producing signal with a pure spectrum.*

Design a monofrequency transistor oscillator with frequency  $f = f_0$  in the structure of the microstrip line. To the protocol note:

- stability factor of the chosen transistor with and without feedback circuit
- reflection coefficient of the microstrip resonator and input stability circle of the transistor with the feedback
- output reflection of the transistor with the connected resonator
- impedance of the output impedance transformer
- schematic of the bias filter
- schematic of the whole transistor oscillator
- output reflection of the whole transistor oscillator

### Project solution procedure

The detailed procedure can be seen on lecture Slide 168. The procedure, in brief, is:

- 1) Choose a proper transistor. It is best to select a stable one at your design frequency  $f_0$ . You can choose one from Libraries – AWR web site – Parts by Vendor – Renesas (Previously NEC) – Data – Discrete – 3\_SiGeHBT. The NESG2031M05 with 2 V/15 mA bias point works fine for frequencies < 16 GHz. The transistors in AWR web site – Parts by Type – Data – Excelics – LNHGHetJunct data files – NonHerm works for frequencies > 12 GHz.
- 2) Connect the source of the transistor with a ground and add an additional feedback element to the source if necessary.
- 3) Connect the gate to a microstrip resonator. Set the length of this resonator and a value of the feedback element so that  $S_{22}$  has the proper frequency characteristic.
- 4) Design a matching circuit at the drain of the transistor with an impedance transformer for a 50  $\Omega$  output microstrip line.
- 5) Design both the bias filters for the drain and the gate.
- 6) Check if the final reflection coefficient fulfils the resonance condition.