# Assignment 3

Due Thursday April 4, 2019. Submit your assignment using the appropriate Assignment folder on the course web site. Assignments submitted after the solutions are made available will be given a mark of zero. **Show how you obtained your answers.**

Question 1

An RF amplifier chain is composed of a Skyworks SKY65405 LNA, an ON Semiconductor SMA3117 high-gain amplifier and an M/A-Com MAAM-009286 power amplifier:
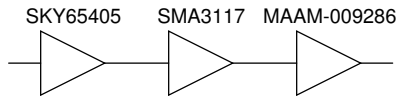
The devices' datasheets are available on the course web site.

(a) For each of the three devices individually, what are the typical values of each of the following?

   (i) current consumption at recommended operating conditions

   (ii) input and output impedances

   (iii) gain

   (iv) noise figure

   (v) *input* IP3

   (vi) *output* P1dB

Show your results in the form of table. For specifications that are not supplied, make an educated guess[1] and show how the value was estimated. Where necessary, use a frequency of 2.45 GHz or the closest frequency for which a specification is supplied.

(b) For the cascade of all three devices, what are the values of the following?

   (i) total current consumption

   (ii) gain

   (iii) noise figure

   (iv) *input* IP3

Question 2

You are making two-tone IP3 measurements of an RF amplifier and see the following spectrum analyzer display for the signal at the output of the amplifier:
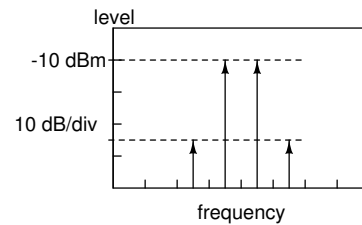
What is the output IP3 of this amplifier?

Question 3

You want to measure the noise figure of an RF amplifier using a spectrum analyzer and a calibrated noise source. When the noise source is off, its noise output is equal to that of thermal noise at $T_0 = 290$ K. When the noise source is on, its noise output is 12 dB higher (i.e. the ENR or excess noise ratio is 12 dB).

The power output of the amplifier is -89 dBm with the noise source off and -80 dBm with the noise source on. What is the noise figure of the amplifier?

You can assume both output power measurements are well above the spectrum analyzer's noise floor so that the spectrum analyzer does not contribute to the measured power.

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[1]For example, IP3 is typically 12 dB higher than P1dB and the output P1dB or IP3 is higher than the corresponding input specification by a factor equal to the gain.