CHALMERS – Space, Earth and Environment

RRY100 – Satellite Communications 2024

Homework 2

Deadline 2024-09-20, 07:59

Receiver systems at microwave frequencies can be used for atmospheric studies. You shall study such a so-called radiometer system which consists of an antenna, a hot load, a warm load, a switch, an RF amplifier, a down convertor, and an IF amplifier. The system has a bandwidth of 1 GHz and other parameters of the receiver equipment are given in Table 1.

The receiver system is equipped with a switch that allows to connect either the antenna, the hot load, or the warm load to the receiving system. When connected, the hot load and the warm load, respectively, act as black body radiators. Table 2 gives the measured output powers P_{hot}, P_{warm}, or P_{antenna}, measured at the output of the receiver system, when either the hot load, the warm load, or the antenna are connected.

Questions:

1. What is the total gain G_{rx} of the receiving system?
2. What is the antenna temperature T_{antenna}?

Table 1: Parameters of the radiometer system.

Equipment	Effective input temperature	Gain
RF amplifier	330 K	?
Downconvertor	580 K	-15 dB
IF amplifier	850 K	?
Hot load	390 K	–
Warm load	290 K	–

Table 2: Measured output power.

P_{hot}	8.5 mW
P_{warm}	7.2 mW
P_{antenna}	6.0 mW

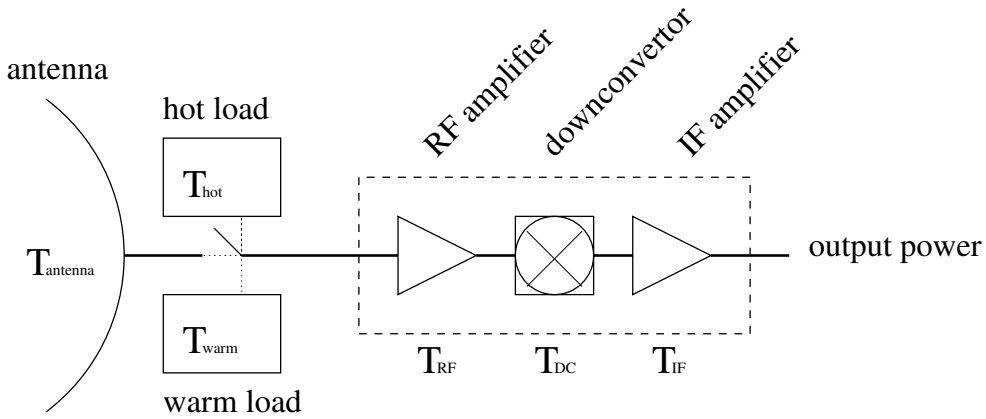

Figure 1: The radiometer system.