4. Transceiver architecture

The block-diagram of the Ka-band transceiver with full modem capabilities is given in figure 2. It is composed by a receiver and a transmitter section sharing a common antenna with polarization diversity. The IF sections of both receiver and transmitter provides (takes) the samples of the I/Q signals to (from) a digital modem. Such a digital circuit implement, in real time, all the demodulation, decoding, error correction, and modulation functions.

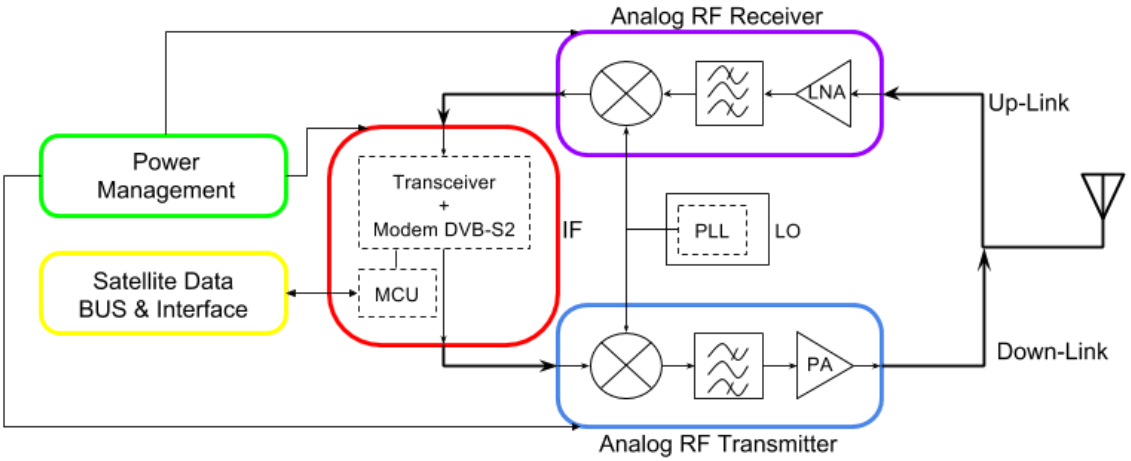

Figure 2. Block diagram of the Ka-band transceiver

The receiver chain exploits a two-stage Low Noise Amplifier (LNA) in order to achieve a low noise figure. The LNA is followed by the image rejection filter: with such an approach the filter loss will affect only in a negligible way the noise performance of the receiver. A waveguide filter before the LNA, instead, has the scope to reject the transmitted power. Such a task will be accomplished in conjunction with the antenna interface. To reduce the losses as much as possible, this filter will have an high-pass behaviour, and will be implemented with a waveguide section that is below cut-off at the TX center frequency (19 GHz) and in propagation at the RX center frequency (29 GHz). The transmitter section is characterized by a saturated output power of 1.5W and exploits a global power control loop (i.e. from the Ka-band output to the transmitter to its baseband input). To this purpose, a Power Amplifier (PA) with integrated power detector is selected. The overall power dissipation of the PA is around to 4.5 W since the efficiency of the selected Integrated Circuits (ICs) at the compression point is typically around 30%. Down- and up-conversions are implemented with single, stand-alone PLL, operating at about 13 GHz. The receiver uses a mixer with integrated frequency doubler for the LO signal (13x2=26 GHz) and has an IF frequency of 3 GHz. The transmitter, instead, has an IF frequency of 6 GHz and a mixer operating at the fundamental frequency.

Intermediate frequencies can be selected individually up to 6GHz, thanks to the capabilities of the AD9364 integrated transceiver from Analog Devices [12]. This integrated transceiver allows conversion to baseband, AD/DA conversion and data interface. It is limited to 56 MHz channel bandwidth, still enough to reach the required data rates. If a higher data rate is needed, however, the, AD9371 integrated transceiver can be adopted. Such a device allows up to 100 MHz (RX) and 250 MHz (TX) channel bandwidths [13].