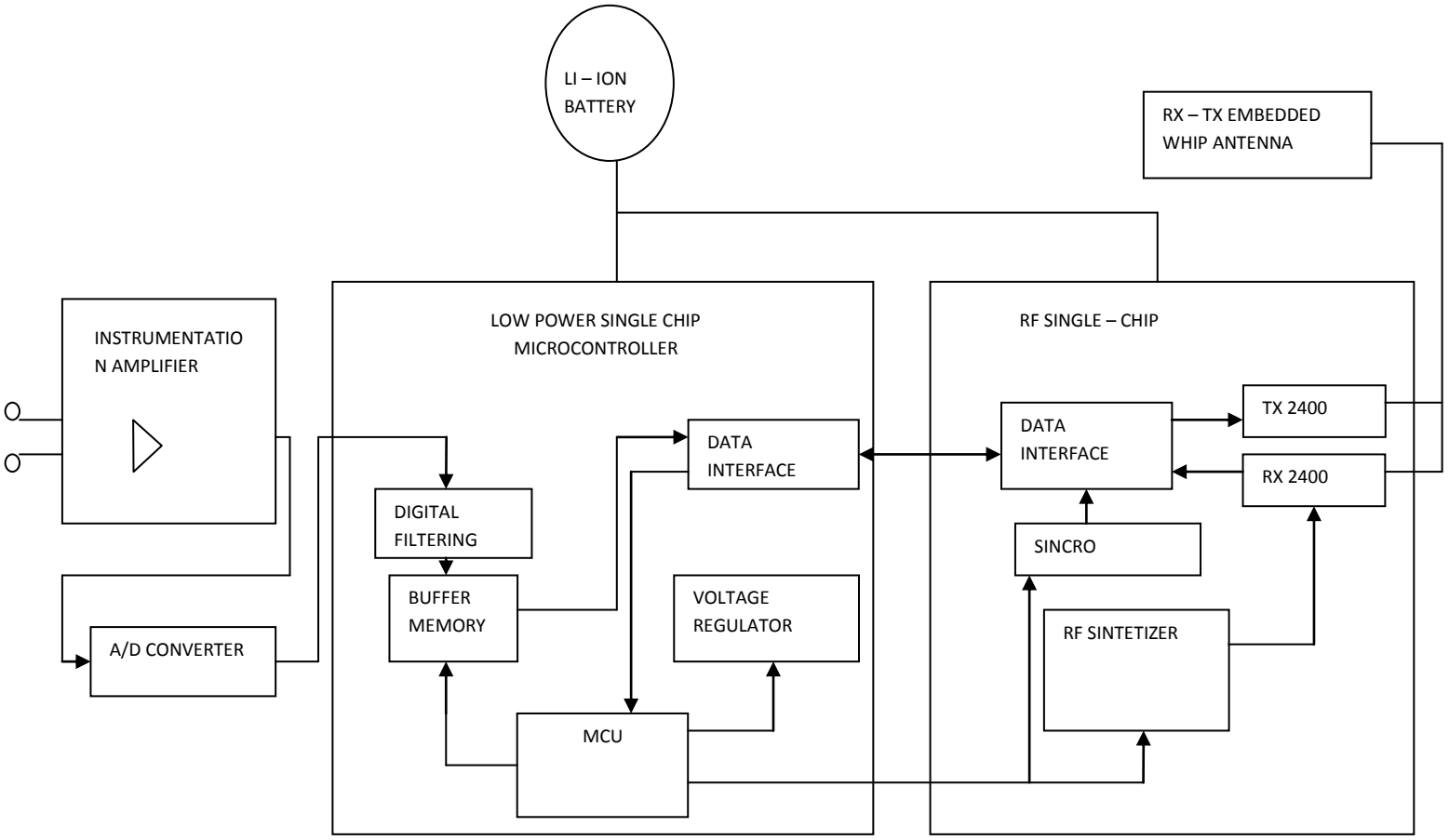
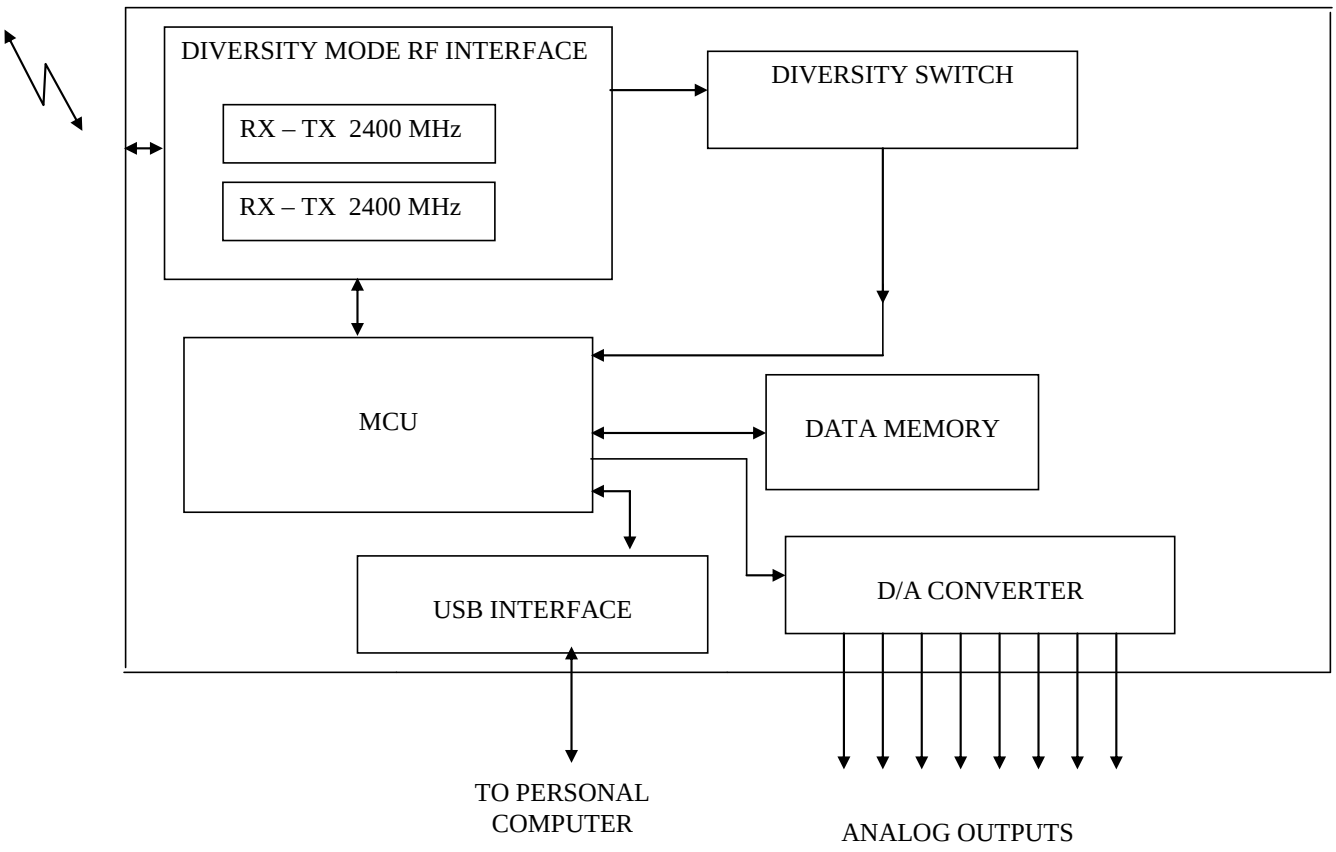
BLOCK DIAGRAMS AND OPERATIONAL DESCRIPTION



Electrode block diagram



Receiver block diagram

OPERATIONAL DESCRIPTION

To transfer information (data and control) from and to the electrodes, Wave Plus uses a single RF frequency in the ISM band, with GFSK modulation. Data are transferred from electrodes to the main receiver on a 14 mSec. frame basis; during the frame, each electrode has its own time slot to transmit a burst of data.

At the beginning of each frame, the main receiver broadcasts a strobe signal to activate and lock the electrodes to the main cycle.

The output power and frequency of the RF modules are programmed in firmware at production time; these parameters are not alterable by the user.

The receiver and electrode RF module is based on the same single chip 2.4 GHz transceiver (nRF24L01+ from Nordic Semiconductors). The block schematic of this device follows:

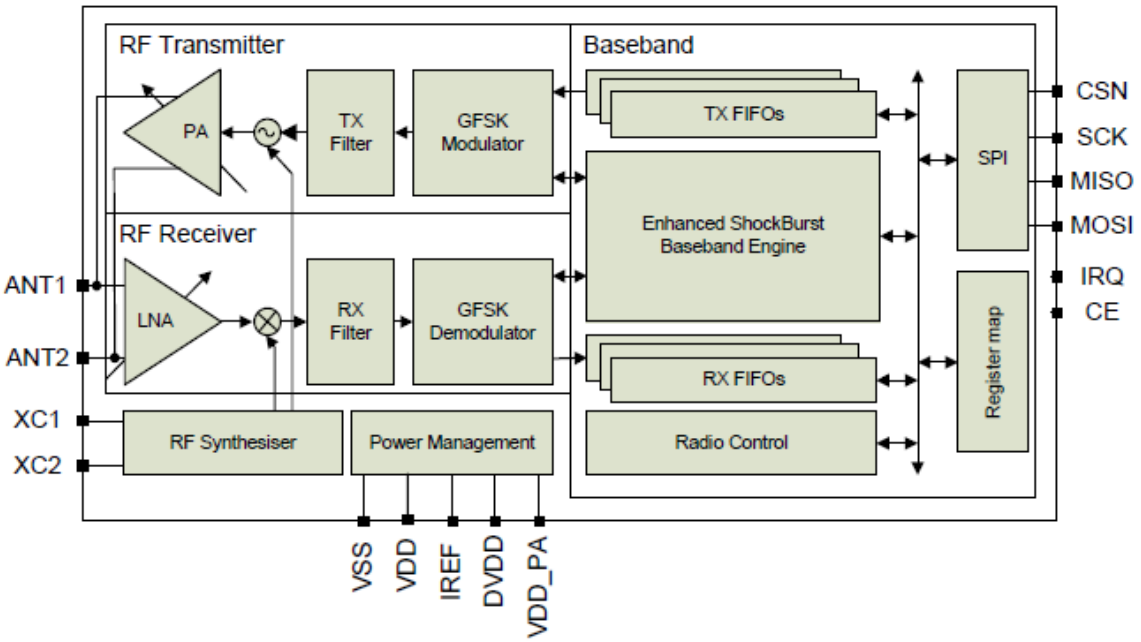


Figure 1. nRF24L01+ block diagram

This device contains all the RX/TX functions, and requires only an external crystal of 16.000 MHz, an external matching network to adapt the balanced ANT1/ANT2 input to the unbalanced 50 ohm antenna, and a MCU to control it.

ELECTRODE

Each electrode is equipped with one RF module, controlled by a low power MCU. The device is switched between RX and TX on a single frequency as follow:

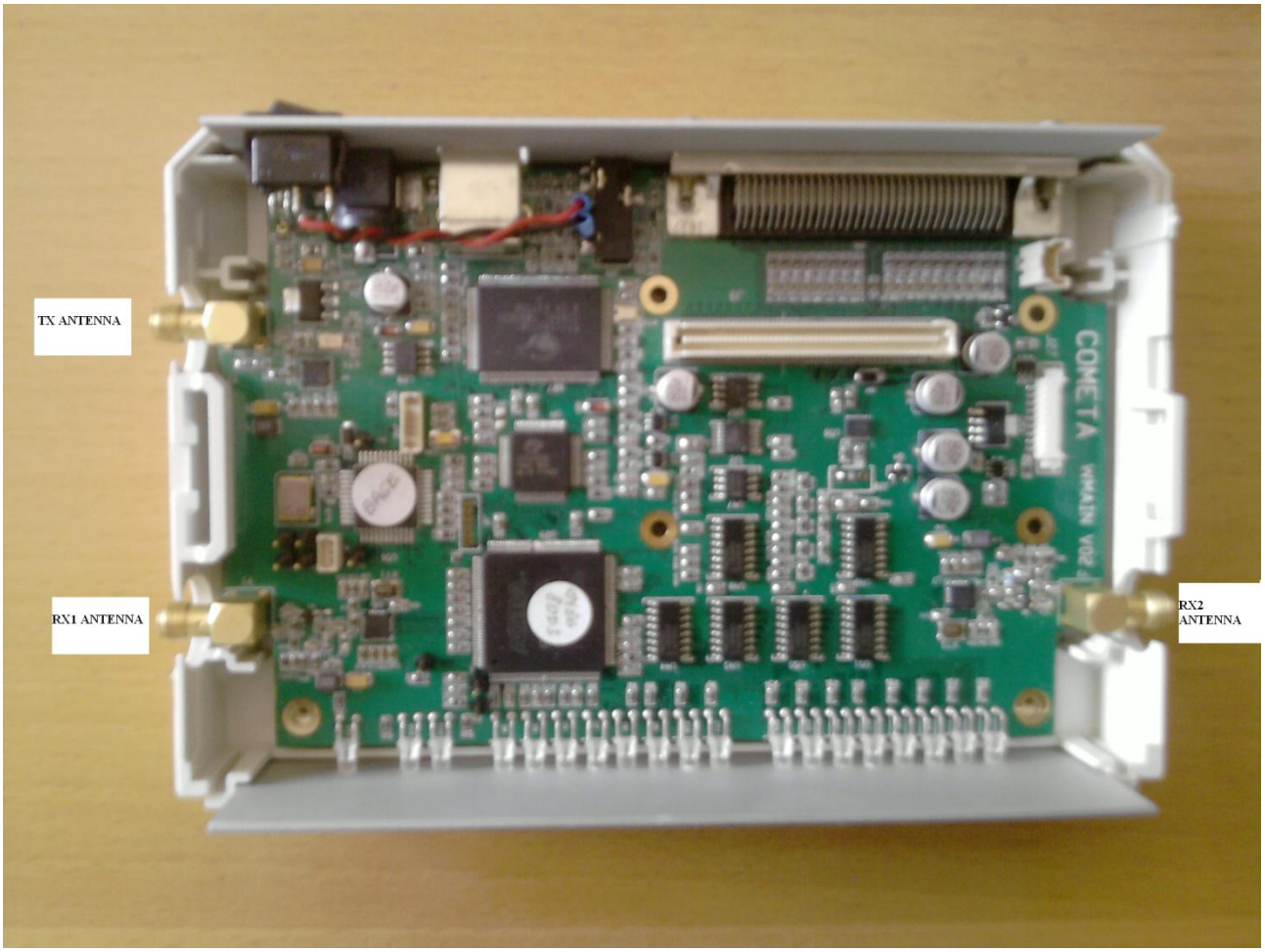
- RX, to receive the activation command from the main receiver unit. The RX is also used during the operating phase, to lock the electrode to the system cycle. The RF frequency used is always the same for all the electrodes (up to 16 electrodes)
- TX, to transmit the EMG data to the main receiver unit.

MAIN RECEIVER

The main receiver is equipped with three RF modules, controlled by a MCU. They work as follow:

- Two RF modules are programmed as receiver, on the same frequency, and work as a “diversity receiver”;
- One RF module is programmed as transmitter, on the same frequency, and is used to broadcast the strobe signal used to activate and synchronize the electrodes.

The output power and frequency of the RF modules are programmed in firmware at production time; these parameters are not alterable by the user.



ANTENNAS

The electrode is equipped with an integral whip antenna, not accessible to the user.

The main receiver is equipped with three SMA connectors and three rubber antennas are supplied.

The compliance with the FCC 15.203 is verified as follow:

- The SMA connector used in Wave Plus is the professional type, and it does not mate with the commonly used “RP” SMA (reverse polarity) used by the commercial WI-FI antennas available on the market;
- A warning is included in the user manual as follow:

> “The main unit is supplied with three rubber antennas that have been selected and certified by the producer to get the best result in every application; the use of different antennas could cause malfunctions or could lead to exceed the specifications of the FCC and CE certification of the device.”