

## PIR Detection and RFID Scan Zones (v1.3)

### Timing Calculations

The **M6e Nano RFID reader** has adjustable power output from 0dBm to 27dBm, meaning that with an external UHF RFID antenna you can read up to 5 m. The UHF RFID Antenna (RP-TNC) WRL-14131 is one of the most common type of RFID antenna, providing a 60 degrees beamwidth. The RFID beam is delineated by the solid line. The **PIR motion sensor SEN-17372** offers digital output across 32 zones at 5m detection distance with 90° horizontal x 90° vertical detection area. The GPIO port is triggered high immediately as a racer enters the PIR detection area (dotted line). A racer arriving at a checkpoint at a maximum speed of 8km/h (2.2 meters per second) will be within the RFID detection area during 1.5 seconds. The PIR will immediately trigger the RFID reader (less than 20ms to RF-on) unless scanning is already active due to other racers just ahead.

The main process running on the Raspberry PI is a loop, constantly monitoring the state of the PIR GPIO port. When the PIR goes high, the RFID reader is scanning tags without any interruption, with the reads being saved into a file. The RFID async scan is terminated after the PIR signal goes low. i.e. there are no more racers being detected. This will provide ample time to scan all racers passing within the detection area at a maximum speed of 8km/h.

