GPS Type Tracker Based On LoRa Transmission for Small Satellites

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Presentation Outline

- Small Satellites (PocketQube).
- MRC-100 3-PQ (PocketQube) class.
- Block Scheme of The GPS Tracker System.
- BME Ground Stations.
- GPS Tracker System Satellite Segment.
- GPS Tracker System Ground Segment.
- Flow Chart of The GPS Tracker system at the satellite segment.
- Flow Chart of The GPS Tracker system at the ground segment.
- Measurement Results of The Received GPS Data as Linear FM Chirp.
- Conclusion.
Student Satellite (PocketQube)

Operated: Masat-1, SMOG-P, ATL-1; Operational: SMOG-1, MRC-100.
MRC-100 3-PQ (PocketQube) Class

MRC-100 POCKETQUBE SATELLITE

- 50 x 50 x 178 mm
- 587 g mass
- −40...+80°C temp. range

Single-point failure tolerant, cold-redundant on-board satellite sub-systems with local intelligence.
Block Scheme of The GPS Tracker System

V-Shapped COMM. antenna

LoRa GPS tracker inside the Satellite

434 MHz LoRa

Down-Link FSK

UHF +70 cm LoRa

434 MHz LoRa

434 MHz LoRa

Ground Station

LoRa GPS tracker

Dogs

LoRa GPS tracker

Cars

LoRa GPS tracker

Birds
BME Ground Stations
GPS Tracker System Satellite Segment
GPS Tracker System Ground Segment

movement sensor

LoRa

transceiver

L86 GPS

programming connector

charger

uUSB

battery conn.
The Realized GPS Tracker System
Flow Chart of The GPS Tracker System at the Ground Segment

1. Start or Wake-up from sleep
2. - init GPS
   - init TVCR
3. Wait for GPS Valid data
   Latitude & Longitude
4. Yes
5. LoRa up-link Packet Transmission
6. - Set GPS to sleep
   - Set LoRa TVCR to sleep
   - Set MCU to sleep for (198 s)
Flow Chart of The GPS Tracker System at the Satellite Segment

- Start or Wake-up from sleep
  - init GPS
  - init TVCR
  - GND new Command
    - GPS wake-up from sleep
    - LoRa TVCR wake-up
    - Wait for GPS valid data
      - Yes
        - LoRa downlink Packet TX to GND
          - Set GPS to sleep
          - Set LoRa TVCR to sleep
          - Set MCU to sleep for (196 s)
      - NO
  - NO
The Received GPS Data as Linear FM Chirp
Conclusion

- The system can receive under noise power level of LoRa modulated signals containing GPS information.
- MRC-100 launched into outer space via a Falcon-9 rocket from the USA on 12 June 2023.
- The first signal from the MRC-100 was received on 22 June 2023.