

Product Family

Digital Advanced Ranging using Transport Stream Signals (DARTS)

Introduction

The DARTS is an implementation of a new and innovative ranging method, using the DVB-S transport stream for precise ranging from one earth station to the satellite. The DARTS has been developed in cooperation between FhG-IIS and SES.

The system allows precise measurements of the round trip delay between a DVB-S transmitter and a receiver. The target application is the orbit determination for geostationary satellites.

After successful completion of laboratory tests, the prototype system has been under long term evaluation including live satellite measurements.

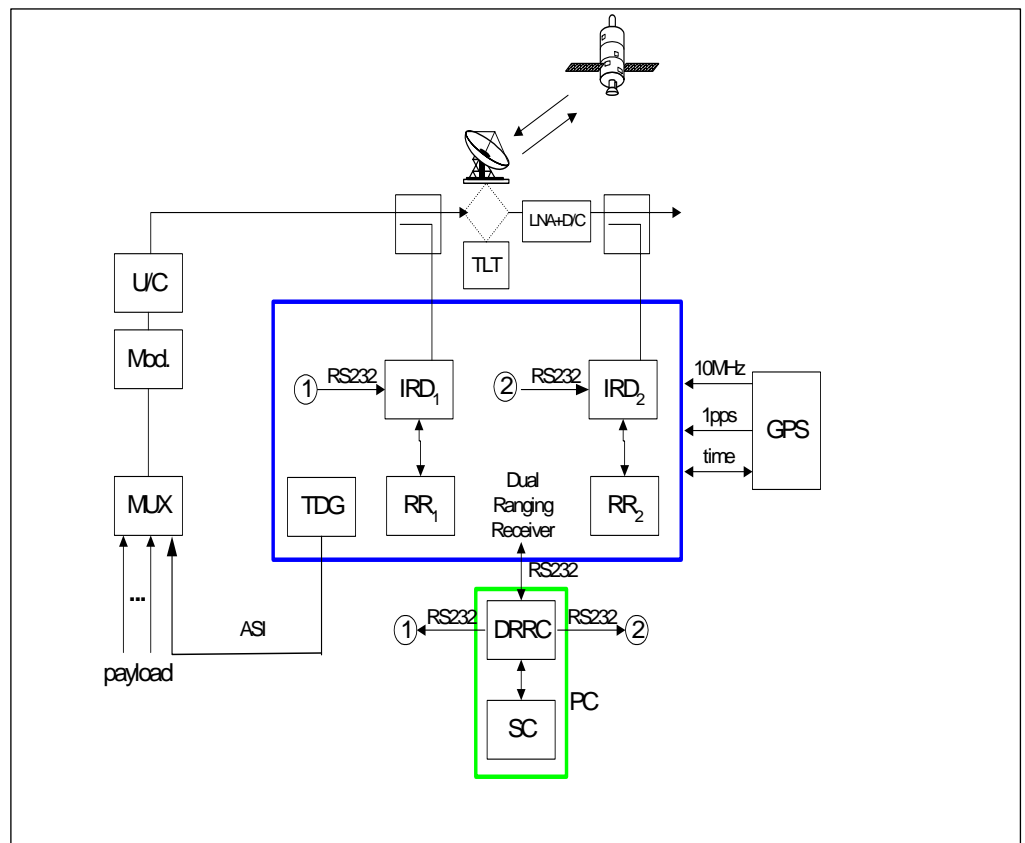


Figure 1: Block Diagram

Description

The DARTS ranging system is based on the precise determination of the arrival time of specific ranging packets at the payload uplink and downlink. It consists of a ranging packet generator, a ranging receiver at the uplink site and at least one ranging receiver at a downlink site.

The Ranging Packet Generator inserts ranging packets into the DVB-S transport stream via a multiplexer or directly into a DVB-S modulator. The round trip delay of the signal on the path between the transmit site – the satellite – and the receive site is determined by the subtraction of packet arrival time at transmission from the packet arrival time at reception.

DARTS Features

▲ System Control Normal

- Fully PC controlled
- Ability to pre-define and schedule different measurement tasks
- Flexible configuration via intuitive GUI
- Remote controllable via TCP/IP connection
- Low-level API available ⇒ software is easy to customise.

▲ System Operation

- Allows precise range measurement from fixed earth stations to geostationary satellites
- Supports device internal and station calibration
- Perform cross- device calibration (between ranging receivers modules on different devices)
- Includes Ranging Packet Generator:
 - Measurement Rate between 1 and 20 measurements /second
 - Generates fully DVB compliant ranging packets of length 188 or 204 bytes
 - Includes stuffing features
 - Connects directly to DVB-S modulator or Multiplexer
- Supports passive multi-site Ranging ⇒ Single site or Trilateration Ranging
- Calculation of absolute packet arrival Time ⇒ Suitable for precise Time Transfer
- Based on state-of-the-art DSP technology

System Components

- Dual Ranging Receivers (DRR)
- PC based Controller with installed
 - Ranging Receiver Controller (DRRC) Software
 - System Controller (SC) Software
- GPS, time and frequency reference
- IRD

Internal Interfaces

- Timing:
 - 10 MHz sine or TTL
 - 1 PPS TTL
 - RS 232 time string
- ASI output for Ranging Packets
- L-band IF signal input 950 – 2150 MHz
- LAN connection for measurement data retrieval

Measurement Accuracy

- Single shot ranging: $1\sigma < 15 \text{ cm}$
- Within 1 second integration time: $1\sigma < 6 \text{ cm}$





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