NavIC based Timing Applications in India

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Timing Solution

- Timing solution finds its uses in various infrastructures of national importance like:
  - Electric power distribution
  - Communication network
  - Satellite earth stations
  - Financial transactions time stamping
  - Time Metrology
  - Scientific research
  - Industrial Control and monitoring

- Accuracy and data format depends on application.

- Time formats: 1PPS, IRIG, NTP, PTP and NMEA.
NavIC System Time

- NavIC System Time start epoch is 00:00 on Sunday August 22nd 1999 (midnight between August 21st and 22nd).
- At the start epoch, NavIC System Time was ahead of UTC by 13 leap seconds. (i.e. IRNSS time, August 22nd 1999, 00:00:00 corresponds to UTC time August 21st 1999, 23:59:47).
- IRNSS system time is given as 27-bit binary number composed of two parameters:
  - Week Number (10 bits) appearing in the first sub frame
  - 17bit Time of Week Count (TOWC) in all four subframes.
- TOW count value ranges from 1 to 50400 to cover one entire week.
- System Time maintained by NavIC ground segment using ensemble of AHM and Caesium clocks.
- NavIC Time is maintained within few ns of UTC(NPLI).
Inhouse development of NavIC Timing receiver at SAC/ISRO.

To cater to need of indigenous time scale for national infrastructure.

Receiver is compatible with existing GPS based timing receivers.

Dual frequency NavIC processing: better accuracy.

Introduction in phased manner.

Enabling industry to introduce NavIC system time in their Timing products.
NavIC Timing Receiver

- Tri-band receiver with L5 & S signals of NavIC and L1 signals of GPS C/A and GAGAN.
- Time solution is obtained from NavIC Dual Frequency (L5+S) processing.
- Outputs: IRIG, Disciplined 10 MHz and 1PPS signals.
- Configurable IRIG Time Code formats -A/B/G XXX
- 1-σ timing accuracy of 15 ns.
- 10 MHz output stability is of the order of $10^{-12}$ when locked to NavIC system time.
NavIC Timing Receiver

IRIG-B120 Output Waveform aligned to 1 PPS signal

Receiver Timing output to Standard IRIG B120 Time Code Reader
NavIC Timing Receiver in Powergrid

- Currently all stations are using Phase Measurement Unit (PMU), which are synchronised across the grid using GPS receiver timing output.
- As a pilot testing, NavIC Timing Receivers are installed at five power grid sites geographically spread across India.
- Receivers are used for time stamping of power grid phasor measurements for Power Grid control, measurements and monitoring applications.
- IRIG-BXXX Time Code format interface with PMU.
- Each site has different make and interface of PMU.
NavIC Timing Receiver in Powergrid

- DADRI
- PATNA
- SHILLONG
- BOISAR
- TUMKUR
NavIC Timing Receiver in Powergrid
Low Cost Timing Receiver

- Small size, Low cost and Low Power Timing receiver using NavIC receiver module.
- Configurable IRIG Time Code formats - A/B/G XXX.
- 1PPS disciplined 10MHz output.

Receiver Timing output to standard IRIG B120 Time Code Reader
NavIC NTP Server

- NTP server with NavIC Time reference established at SAC/ISRO, Ahmedabad
- Synchronization of the computers of Intranet.
- Time server for Centre for Railway Information System (CRIS) over Internet.
- This is in operation as 24x7 service.

In house developed NTP server

NTP server Implementation on Raspberry PI
NavIC Time on Webpage

https://sac.gov.in/Vyom/time_current.jsp

14:05:02 (IST)
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- Time display at public establishments.
- Accurate and stable clock.
Thank You