




**smart**  
positioning



# **SiRF low power operation modes**

## **2009-04-08 rev 1.2**

### **Timo Saarnimo**



# TricklePower

## TricklePower mode:

- Fix rate adjustable between 1 s and 10 s
- Current HW requires GSW3.2.4 firmware
- Average power consumption is reduced, depends on duty cycle
- Receiver stays active only fraction of a second between fixes
- Rest of the time receiver stays in standby state (CPU clock is stopped) and consumes only 1mA (LP/LT) or 0.7mA (LPx)
- Power supply is kept active all the time
- Configured with SiRF binary command
  - See binary manual, command ID151
- Accuracy & signal levels may be reduced
  - The more receiver is allowed to track signals, the less is the impact on accuracy
- Receiver switches automatically to Full Power mode once in a while to collect new ephemeris (duration 30 sec) & almanac (duration 12 minutes) or if signal levels are low

## TricklePower mode:

- **Example of power reduction (duty cycle):**
  - **Add 200ms overhead due to CPU only state that follows On-Time**

Table 2-37 Example of Selections for TricklePower Mode of Operation

Mode	On Time (ms)	Duty Cycle (%)	Interval Between Updates (sec)
Continuous <sup>1</sup>	200 <sup>2</sup> (≅ 1000)	100	1
TricklePower	200	20	1
TricklePower	200	10	2
TricklePower	300	10	3
TricklePower	500	5	10

1. when the duty cycle is set to 100 %, the on time has no effect. However, the command parser might still test the value against the 200-600 ms limits permitted for a 1-second cycle time. Therefore, we recommend that you set the on-time value to 200 ms.
2. When the duty cycle is set to 100%, the value in this field has no effect. Thus, any legal value (100 to 900) may be used.

**TricklePower mode:**

- **ID151 command:**
  - **Specify ON-Time & Duty Cycle**

Table 2-36 Set TricklePower Parameters – Message ID 151

Name	Bytes	Binary (Hex)		Unit	Description
		Scale	Example		
Message ID	1 U		97		Decimal 151
Push-to-Fix Mode	2 S		0000		ON = 1, OFF = 0
Duty Cycle	2 S	*10	00C8	%	% Time ON. A duty cycle of 1000 (100%) means continuous operation
On-Time <sup>1</sup>	4 S		000000C8	msec	range 200 - 900 msec

Set OFF  
In hex  
In hex

Payload length: 9 bytes

1. On-time of 700, 800, or 900 ms is invalid if an update rate of 1 second is selected.

## TricklePower mode:

- **Duty cycle settings:**
  - **Remember to convert values to hex number**

Table 2-38 Duty Cycles for Supported TricklePower Settings

On-Time (ms)	Update Rates (sec)									
	1	2	3	4	5	6	7	8	9	10
200 <sup>1</sup>	200	100	67	50	40	33	29	25	22	20
300	300	150	100	75	60	50	43	37	33	30
400	400	200	133	100	80	67	57	50	44	40
500	500	250	167	125	100	83	71	62	56	50
600	600	300	200	150	120	100	86	75	67	60
700	Value not permitted	350	233	175	140	117	100	88	78	70
800	Value not permitted	400	267	200	160	133	114	100	89	80
900	Value not permitted	450	300	225	180	150	129	112	100	90

1. When the duty cycle is set to 100%, the on time has no effect. However, the command parser may still test the value against the 200-600 ms limits permitted for a 1-second cycle time. Therefore, set the on-time value to 200 ms.

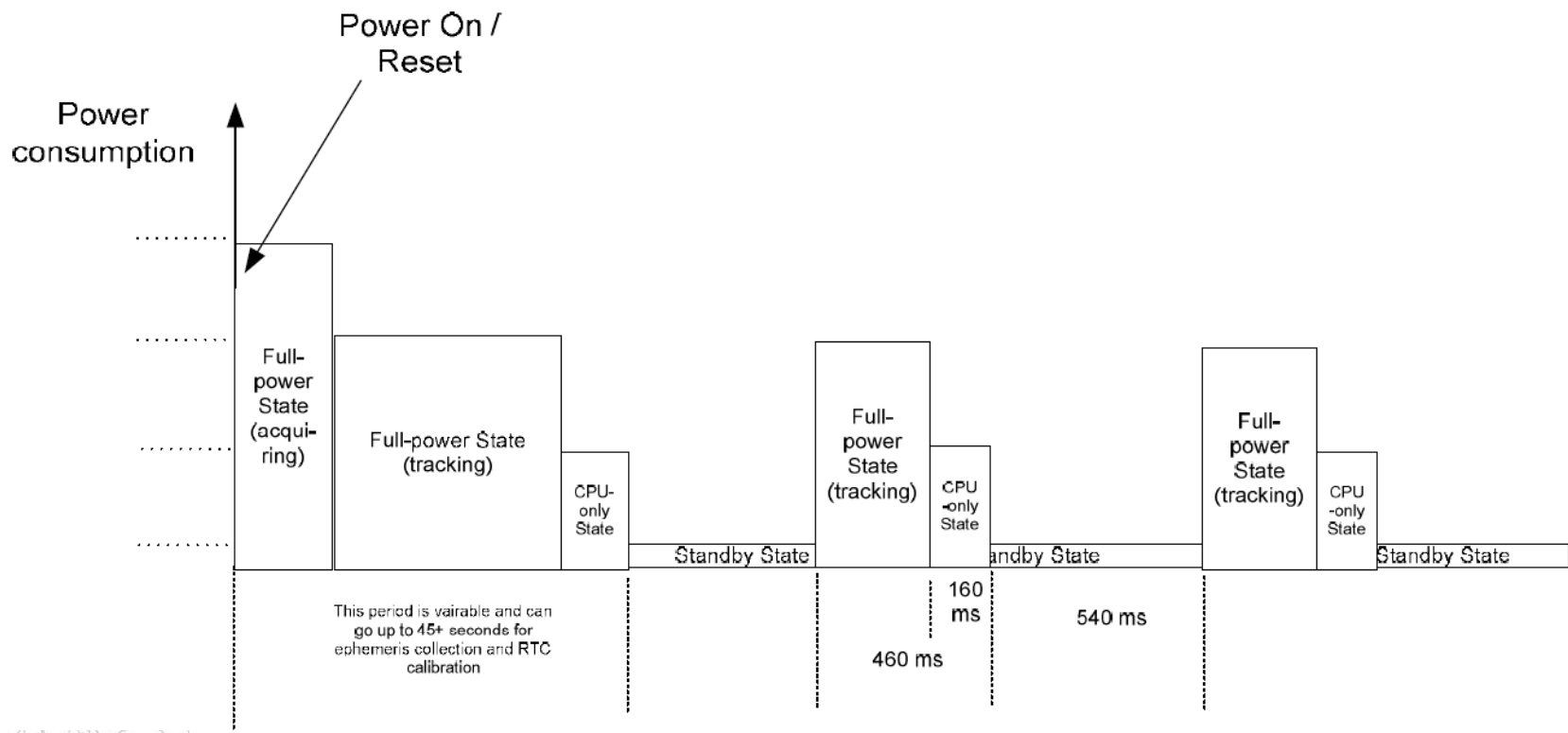
---

**Note** – Values are in % times 10 as needed for the duty cycle field. For 1 second update rate, on-times greater than 600 ms are not allowed.

---

## Power drain:

- Example of 300ms ON-time @ 1 sec interval



## TricklePower mode in practice:

- After power up or cold start receiver operates in Full Power mode about 60 sec
- TricklePower mode starts according to host command
  - After cold start the receiver changes to Full Power mode 18 sec @ every 30 sec to collect current almanac data. This state lasts 12 minutes and it happens only once in a week.
- Rest of the time receiver stays in TricklePower mode and changes adaptively to Full Power mode only when needed



## Adaptive change from TricklePower to Full Power mode:

- Receiver changes adaptively to Full Power mode:
  - When signal levels are below 26dBHz @ four strongest satellite signals
    - Returns to TricklePower mode when signal levels are above 30dBHz @ four strongest satellite signal
  - To collect periodic ephemeris data, to calibrate RTC etc. abt. 30 sec (every 700... 3000 sec period)
  - To collect periodic almanac data, 18 sec @ 30 sec for 12 minutes (once in a week)
  - To improve navigation result
    - When signal levels of the four strongest satellite are weak close to 30 dBHz, the receiver increases Full Power mode duty cycle in contrast to TricklePower mode



# Push-to-Fix

## Push-to-Fix mode:

- Sets receiver in a background duty cycle mode
- Provides automatically periodic refresh of
  - Position, Ephemeris, RTC calibration
- Enabled by binary command ID151 (set Push-to-Fix 'ON')
- Host may push a fix at any time by sending a pulse to ON\_OFF control input
  
- Default cycle period 30 minutes (1800 sec)
  - After elapsed time receiver starts at Full Power Hot/Warm start mode and tries to download new ephemeris and to provide a valid fix, max search time 120 sec (default *Max Search Time*)
  - If the search fails, receiver will de-active for 30 sec (default *Max Off Time*)
  - Other values can be issued by binary command ID167

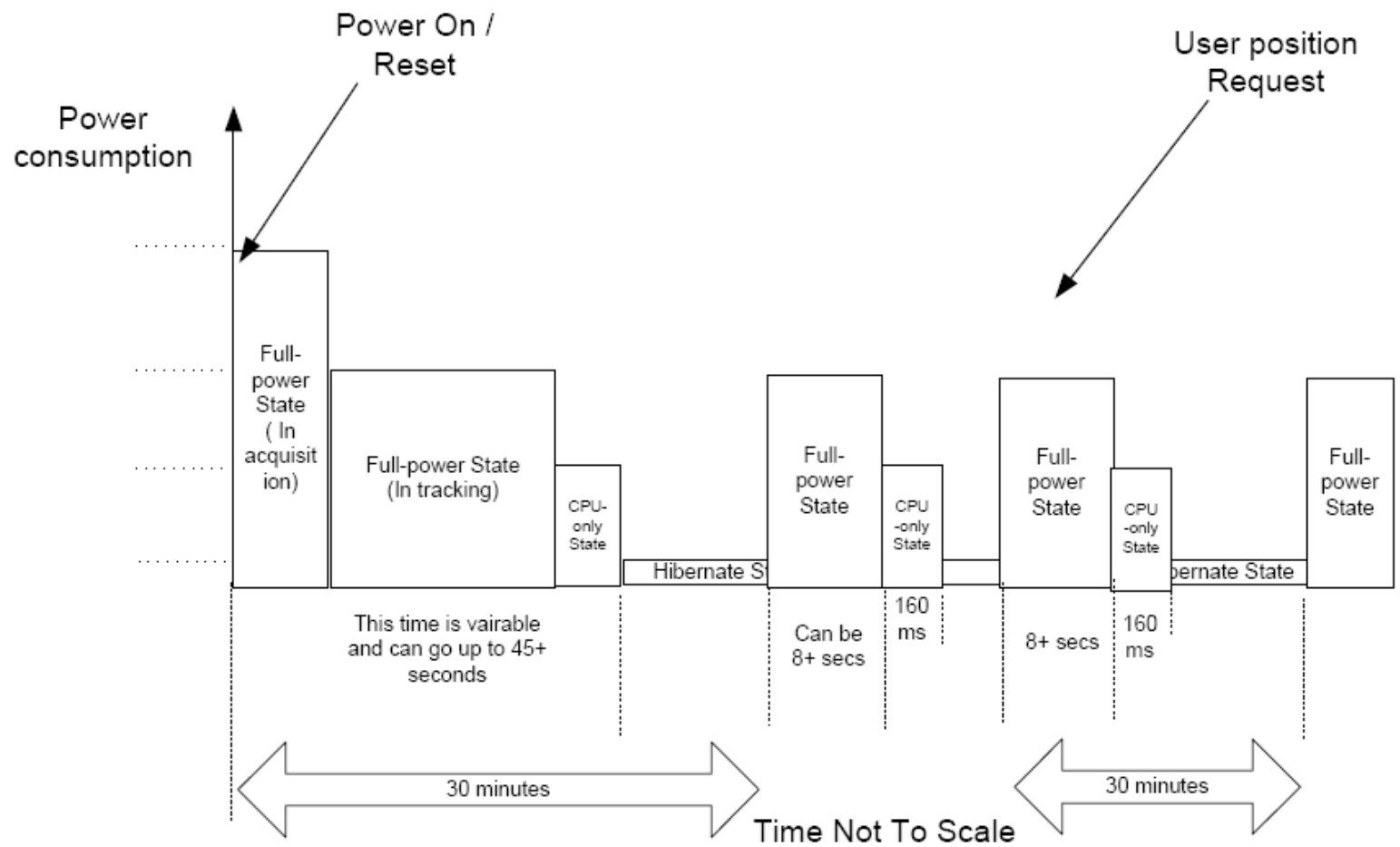
## Push-to-Fix mode:

- Rest of the time the receiver stops all firmware execution and stays in low power CPU-only state or Hibernate state depending on the module type
  - If the receiver supports Hibernate state, the main supply voltage is also internally switched off to reduce power drain (back up power remains active)
  - Hibernate state requires GSW3.2.5 or higher firmware
    - IT321, UC32x supports Hibernate state natively, current about 20uA
    - IT300, IT310, IT350, UP300: Hibernate state not supported, CPU-only state current drain about 4mA
      - The host can imitate Push-to-Fix operation by allowing the receiver once in while to track > 40... 60 sec and dowload new ephemeris data and then turn off the main supply.

## Push-to-Fix mode, wake-up:

- Host can push a valid fix by waking up the receiver by sending a wake-up interrupt to ON\_OFF control input
  - ON\_OFF pulse > 70 us, typical 100 ms
  - Use only when in CPU-Only/Hibernate mode, i.e. when no data messages are received from UART
  - Note: be carefull when sending ON\_OFF interrupt. If the receiver is already at full power (navigating), it will enter Hibernate (or CPU-only) state.
- If the receiver supports Hibernate mode, the main voltage supply is autonomously switched on during wakeup
- TTF about 8+ sec (depends on satellite visibility & signal levels)

## Push-to-Fix mode:



## Notes:

- Dual UART protocol configuration (STD firmware) requires the binary commands to be sent at UART B. This firmware variant is not suggested for low power modes.
- Single UART protocol (CAR firmware etc.) requires switching from NMEA to binary protocol (NMEA command \$PSRF100)
  - After configuration you may switch back to NMEA protocol (bin command ID129)
- Settings are valid as long as
  - the back-up power supply is active (IT300, IT310, IT350, UP300)
  - The main supply is active (IT321, UC32x)
- Detailed information at SiRF
  - Binary protocol manual
  - App Note APNT3008
- SiRFDemo has some limitations in TricklePower/Push-to-Fix settings; use instead the Action/Transmit Serial Message/Sirf binary