SPIDER & HORNET – SiRFStar V
Low Power Operating Application Notes

OriginGPS.com
1. SCOPE

This document describes Low Power Operating Modes in Spider and Hornet modules which contains SiRFStar V chipset only.
Low Power Modes for the following modules are covered in this manual:
ORG1510-r01
ORG1518-r01
ORG4500
ORG4502
ORG4572-r01

In case you are using a Spider / Hornet which is based on a chipset other that SiRFStar V – please relate to its appropriate manual.

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3. SAFETY INFORMATION

Improper handling and use can cause permanent damage to the product.

4. ESD SENSITIVITY

This product is ESD sensitive device and must be handled with care.

5. CONTACT INFORMATION

Support - info@origingps.com or Online Form
Marketing and sales - marketing@origingps.com
Web – www.origingps.com
6. RELATED DOCUMENTATION

<table>
<thead>
<tr>
<th>No</th>
<th>DOCUMENT NAME</th>
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<tbody>
<tr>
<td>1</td>
<td>Spider and Hornet - NMEA Protocol Reference Manual for CSR® based receivers</td>
</tr>
<tr>
<td>2</td>
<td>Spider and Hornet - One Socket Protocol Reference Manual for CSR® based receivers</td>
</tr>
<tr>
<td>3</td>
<td>Spider and Hornet - One Socket Protocol GNSS Extensions Reference Manual</td>
</tr>
<tr>
<td>4</td>
<td>SiRFLive FAQ</td>
</tr>
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</table>

TABLE 1 – RELATED DOCUMENTATION

7. REVISION HISTORY

<table>
<thead>
<tr>
<th>REVISION</th>
<th>DATE</th>
<th>CHANGE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>November 8, 2016</td>
<td>First release</td>
</tr>
</tbody>
</table>

TABLE 2 – REVISION HISTORY

8. GLOSSARY

A-GNSS Assisted GNSS
CGEE™ Client Generated Extended Ephemeris
CMOS Complementary Metal-Oxide Semiconductor
COMPASS PRC GNSS (same as BDS BeiDou-2 Navigation Satellite System)
EVB Evaluation Board
EVK Evaluation Kit
FP Full Power
GALILEO EU GNSS
GLONASS Global Navigation Satellite System
GNSS Global Navigation Satellite System
GPS Global Positioning System
I²C Inter-Integrated Circuit
IC Integrated Circuit
NFZ™ Noise-Free Zones System
NMEA National Marine Electronics Association
MEMS MicroElectroMechanical Systems
PCB Printed Circuit Board
PPS Pulse Per Second
PTF Push To Fix
QZSS Quasi-Zenith Satellite System
REACH Registration, Evaluation, Authorisation and Restriction of Chemical substances
RF Radio Frequency
ROM Read-Only Memory
RTC Real-Time Clock
SAW Surface Acoustic Wave
9. ABOUT ORIGINGPS

OriginGPS is a world leading designer, manufacturer and supplier of miniature positioning modules, antenna modules and antenna solutions.

OriginGPS modules introduce unparalleled sensitivity and noise immunity by incorporating Noise Free Zone system (NFZ™) proprietary technology for faster position fix and navigation stability even under challenging satellite signal conditions.

Founded in 2006, OriginGPS is specializing in development of unique technologies that miniaturize RF modules, thereby addressing the market need for smaller wireless solutions.
10. LOW POWER MODES - INTRODUCTION

All OriginGPS modules support self-managed power modes. Self-managed power modes allow commands to set the basic operating parameters for an application and then use heuristic software and hardware algorithms to optimise the power consumption to suit external conditions in that specific operating mode.

10.1. POWER STATES

There are two main basic operating states for Spider and Hornet modules: FULL POWER and HIBERNATE. All self-managed reduced power modes are variations of FULL POWER and HIBERNATE states controlled by internal algorithms and timers.

**FULL POWER state:** in this state the module is fully operational. Typically when powered on, the module is acquiring satellites, a stage which is called Acquisition.

During the acquisition, processing is more intense than during tracking, thus consuming more power. After achieving the first fix, the module is in tracking. In first phase of tracking the module captures ephemeris data. In this stage, the processing is also intense and module consumes more power. After the module finishes capturing ephemeris and Almanac data – power consumption drops.

As long as the module stays in Full Power state, it continously reports position fixes via NMEA / OSP protocol for the best all-around performance. The receiver is able to receive commmands from host.

**FULL POWER 5 Hz state:**

Operation is the same as for full power at 1 Hz with navigation message at 5 Hz rate. Serial port overflow can occur if too many messages are enabled and host serial interface speed is too low. None of the power managed modes operate with navigation computation rate at 5 Hz. Current consumption is higher due to much higher activity of the CPU in generating messages and fixes.

**HIBERNATE state:** maintains Finite State Machine (FSM), RTC oscillator and counter, preserves contents of BBRAM, patch RAM, some hardware registers and preset values for GPIOs.

While in Hibernate, the module does not transmit location and cannot receive commands from host.

**STANDBY state:** is similar to HIBERNATE but with the addition that the ARM processor domain remains powered but without the processor clock running. STANDBY enables the system to resume operations from the point in the code where STANDBY state was entered.

While in Standby, the module does not transmit location and cannot receive commands from host.

**CPU ONLY state:** transitional state between Full Power and Hibernate. The receiver enters this transitional state briefly in order to do some power and serial-I/O housekeeping.

**OFF state:** This state is completely unpowered.

There are significant tradeoffs in performance when the module is first returned to active operation. Without host assistance, it requires complete re-learning of all satellite data, time and location. With help
from an associated host or associated memory device, previous data that was saved can be restored to the receiver to assist search and data for a position fix.

10.2. ACQUISITION TIMES

TTFF (Time To First Fix) – is the period of time from GPS power-up till position estimation.

**Hot Start:** A hot start results from software reset after a period of continuous navigation or a return from a short idle period that was preceded by a period of continuous navigation. In this state, all of the critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in SRAM.

**Warm Start:** A warm start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available in memory. In this state, position and time data are present and valid, but ephemeris data validity has expired.

**Cold Start:** A cold start acquisition results when either position or time data is unknown. Almanac information is used to identify previously healthy satellites.

**Aided Start:** Aiding is a method of effectively reducing the TTFF by host assistance. Aiding makes every start Hot or Warm.
11. PUSH-TO-FIX (PTF™)

11.1. BACKGROUND

Push-To-Fix II (PTF™) mode in SiRFStar V based modules has been improved over original Push-to-Fix mode in previous versions in SiRFStar IV and earlier. PTF mode is best suited for applications that require infrequent navigation solutions, optimizing battery life time.

In PTF mode the module is mostly in Hibernate Mode, drawing < 40µA, waking up for Ephemeris and Almanac refresh in fixed periods of time.

The PTF period can be programmed at 6 seconds or between 30 and 86400 seconds at modulo 30 seconds. Typical use would be a rate of less than 7200 seconds. Once Push-To-Fix II cycling has been entered, upon wakeup the receiver will stay in full power until a good navigation solution is computed or a timeout is exceeded.

When the PTF mode is set, the receiver will stay on full power until the good navigation solution is computed. After a good position fix is received and several satellites’ data updates are made—the receiver will go back to Hibernate mode.

The user no longer needs to wait for a good navigation solution before requesting Push-To-Fix to be entered. Push-To-Fix II can be requested at any time and the unit will enter into Push-To-Fix II when possible. If it is not currently possible to enter directly into Push-To-Fix II cycling, the unit sleeps for the specified Off Time and then tries again. When the initial starting conditions of a ephemeris collected and a good navigation solution is completed the unit enters into Push-To-Fix II cycling. Push-To-Fix II has improved power consumption and data collection. The user can select a Search Time that is only a few seconds and no longer needs to include the time to collect the ephemeris in the Search Time. For example the user could select a 6 second Search Time with a 120 second update Rate. When it is necessary to stay awake to collect ephemeris, the unit extends the period until the collection has completed and then resumes normal Push-To-Fix II cycles. Push-To-Fix II has Extended Ephemeris support when enabled.

A good navigation solution includes a user-settable internal quality of service check to verify a reasonable solution. If a timeout is reached the unit sleeps in HIBERNATE state for the time specified in the off Time. If a good navigation solution is computed and maintenance is not required, the unit sleeps in HIBERNATE state for the remaining time in the cycle. If maintenance is required the unit extends the active time to complete the ephemeris collection and then returns to Hibernate.

When the host application needs a position report, it can pulse the ON_OFF pin to wake up the receiver. The ON_OFF pin is pulsed only when the receiver is in HIBERNATE state. The host can sense module’s state by monitoring the WAKEUP output level, or by monitoring the receipt of “OK to Send = True” message (PSRF150 in NMEA or MID18 in OSP) from the module. Whenever the module goes to Hibernate state, “OK to send” message is sent with a “false” value. Whenever the module wakes up from Hibernate to Full Power - “OK to send” message is sent with a “true” value.

When the receiver wakes up because of the ON_OFF pin, a new Push-To-Fix II cycle begins resetting all variables related to handling the wakeup and sleep time.

In case you want at that stage to keep the module permanently in Full Power and not continuing Push-To-Fix cycles – you must send a command to exit Push-To-Fix and enter Full Power mode. See section 16.4 for full information about the Full Power command.

If programming the module for PTF is not required, the ON_OFF input may be controlled by host routine that toggles between Hibernate and Full Power operation modes to save battery.
Example of current consumption estimation:

To exit PTF mode to permanent Full Power – a “Full Power” command is required. See section 16.4 for full information about the Full Power command.

Important: While the module is in Hibernate state – it can be woken up only by hardware. The receiver will not receive any software command while in Hibernate.

11.2. PARAMETERS

Power Modes software commands can be sent only in OSP protocol. If NMEA protocol is required – you can switch back immediately after setting the power mode.

The command of switching from OSP to NMEA protocol must be sent before the module enters the Hibernate mode. See Section 16 for detailed commands.

While setting Push To Fix mode, the following parameters should be entered:

1. Push-to-Fix Period - Period for one cycle in seconds. Range: 6 seconds or between 10 and 86400 seconds at modulo 30 seconds. Typical use would be a rate of less than 7200 seconds.

2. MaxOffTime – Off time in seconds. Maximum time for sleep mode between acquisition attempts. When module is unable to find signals during MaxSearchTime. Range 6 to 7200 seconds.

3. MaxSearchTime - Time in seconds the module searches for a signal in one cycle. When the module is unable to reacquire at the start of a cycle, this parameter determines how long it will try to reacquire for. After this time expires, the unit returns to sleep mode for the value
Fields MaxOffTime and MaxSearchTime specify the amount of time the module uses hibernating when it cannot find a signal and searching for signals when that period is complete.

### 11.3. PROS AND CONS

**Pros:**
- Self-contained, no additional software implementation is necessary.
- RTC block is running, providing up-to-date clock.
- Last known position and Almanac are present in RAM.
- Long HIBERNATE time and allows long cycles—over 2 hours.
- Prepared to wake any time in response to an edge on the ON_OFF pin

**Cons:**
- Permanent small current consumption while in Hibernate (compared to Powered Off state).
12. DEMONSTRATION – PUSH TO FIX IN SIRFLIVE SOFTWARE

12.1. SIRFLIVE TOOL OVERVIEW

The SirfLive Tool is an evaluation, demonstration and training software for Spider / Hornet features. You can find more information regarding SirfLive tool in OriginGPS SiRFLive FAQ document.

A. Connect OriginGPS EVK to PC.
B. Double click the SirfDemo software shortcut.
C. “Connection Settings” window will open:

![Connection Settings Window](image)

D. Physical Connection: Select “RS232/USB”
E. Receiver: Select the Virtual COM port number as assigned by the driver.
F. Baud Rate: Select “4800” for 4,800 bps.
G. Press the “OK” button when finished.
H. The NMEA messages will start running in “Debug View” Window.
I. Switch protocol to OSP Binary protocol by “Receiver” → “Command” → “Switch Comm Settings”.

![Switch to Sirf Protocol](image)
J. Select “Switch Protocol (to OSP)” and choose the desired baud rate.

K. Setting Low Power mode.
   Press on “Receiver” → “Command” → “Switch Power Mode”.

FIGURE 4 – SELECTION OF PROTOCOL AND BAUD RATE

FIGURE 5 – ENTERING LOW POWER MODE MENU
L. Low Power window will open:

![FIGURE 6 – SET LOW POWER MAIN DIALOG](image)

M. Select “Push to fix” in Power Mode mode,
- Enter “Push to Fix Period” – the cycle period, in seconds. Default Value: 10 seconds.
- Enter the Maximum search time (mS) (default value: 120,000mS i.e. 2 Minutes) and the Max Off Time (ms) (default value: 30,000 ms i.e. 30 seconds) and press the OK button.

Please notice: the module will enter PTF™ mode only if there is a fix and in good signal level. In poor signal level – bellow 30dB-Hz, the module will not enter low power mode. It will stay in Full Power.

N. Every cycle of Push To Fix mode will appear as a Low Power Reset in “TTFF/Nav Accuracy” window. This is a good indication that the module entered the “Push to fix” low power mode. You should also notice that the satellites SNR values in Signal View are “frozen” and do not change for a Hibernate period of the cycle.

![FIGURE 7 – LOW POWER RESET IN TTFF/NAV ACCURACY WINDOW](image)
O. In case you toggle On_Off pin/button – it will also appear as Low_Power reset. The module will transform to Full Power, report position and go back to Hibernate.

13. TRICKLE POWER MODE

13.1. BACKGROUND

TricklePower saves power by cycling between full power with RF and CPU on, a CPU-only mode, and STANDBY. TricklePower mode supports a 1 Hz message rate with user controls for duration of on time. TricklePower switches to full-power in a weak-signal environment or if valid fix is lost. The receiver does not use GLONASS while in TricklePower cycling, but does keep GLONASS satellites updated during maintenance cycles.

TricklePower Mode is best suited for applications that require solutions:
- At a fixed rate
- With low-power consumption
- With the ability to track weak signals retained

Duty cycling of the receiver reduces the responsiveness of the module under conditions of acceleration in dynamic applications such as jogging, cycling, driving, marine (wave motion). The TricklePower algorithm requires that the receiver operate in full-power operation until a valid position fix is achieved. The receiver enters TricklePower mode at the preset duty cycle and report rate. At wakeup, the receiver collects pseudorange measurements, computes a navigation solution, sends out the navigation messages, and returns to STANDBY until the next cycle starts. If power to the Keep Alive (KA) section is lost for any reason, the system reverts to the original factory settings and that can result in an extended TTFF start-up. With reduced signals, the receiver automatically switches to continuous full power mode to improve navigation performance. The criteria to enter and remain in TricklePower is a valid position fix with four or more tracked satellites with signals greater than 30 dbHz, otherwise the receiver switches to full power. The receiver requires full power mode when a refresh of the broadcast data stream is scheduled. This results in variable power savings with predictable performance. Position error with TricklePower is increased.

Position requests are set for a specific update period (1 to 10 seconds), and a specific RF sampling time during each period (100ms to 900ms). The receiver returns to the FULL POWER state for the sampling time to collect measurements, reduces power to the CPU_ONLY state to process the navigation solution, and then operates in STANDBY state for the remainder of the update period. The next FULL POWER state is initiated by an RTC wake-up.

A toggle of On_Off pin while in Trickle Power mode will transform the module to Full Power.

Figure 8 shows a typical state transition diagram.
FIGURE 8 – THE TRICKLE POWER CYCLE

13.2. PARAMETERS

While setting Push To Fix mode with OSP command, the following parameters should be entered (see section 16.3 for the full command):

1. **Update Rate** – Duration of a cycle, in seconds. Navigation solution update rate.
   The module will wake up and get position fix once in a cycle.

2. **On_Time** – Time RF section is on, in milliseconds, in multiples of 100 milliseconds only.
   Range 100 to 900.

3. **MaxOffTime** – Off time in seconds. Maximum time for sleep mode between acquisition attempts.
   When module is unable to find signals during MaxSearchTime. Note: When specifying a longer interval for update rate, the maxSearchTime should also be increased.

4. **MaxSearchTime** – Time in seconds the module searches for a signal in one cycle.
   When the module is unable to reacquire at the start of a cycle, this parameter determines how long it will try to reacquire for. After this time expires, the unit returns to sleep mode for the value set in the MaxOffTime.
   The actual time value is resolved to increments of 30 seconds.

Fields MaxOffTime and MaxSearchTime specify the amount of time the module uses hibernating when it cannot find a signal and searching for signals when that period is complete.
13.3. TRICKLE POWER DEMONSTRATION IN SIRFLIVE SOFTWARE

Repeat stages A to L from section 12.1 - SIRFLIVE TOOL OVERVIEW to Select “Switch Protocol (to OSP)” and choose the desired baud rate.

![Selection of protocol and baud rate](image1)

FIGURE 4 – SELECTION OF PROTOCOL AND BAUD RATE

Setting Low Power mode. Select the TricklePower™ in the Power Mode window:

![Entering TricklePower parameters](image2)

FIGURE 10 – Entering TricklePower parameters

In order to control the power consumption, you can setup the On Time- the period that the RF section is on.

Maximum Search Time: how long the system should attempt to acquire satellites and navigate.
Maximum Off Time: how long the GPS receiver should remain off (sleep mode) before making another attempt to navigate. The default values are as follows: Update rate 1 seconds, On Time 200 milliseconds, Maximum off time 30 seconds, Maximum search time: 2 minutes. After input of the parameters press the OK button.

Please notice: the module will enter Trickle Power mode only if there is a fix and in good signal level. In poor signal level - bellow 30 dB-Hz - the module will stay in Full Power.

There are 2 options to get indication whether the module entered Trickle Power mode: 1. The SV’s SNR values in Signal View window should “freeze”, and get updated for a “On Time” ones every cycle.

2. If you switch the protocol to NMEA while in Trickle Power mode, you will see that for every cycle the NMEA flow stops with a message “Not OK to send” - $PSRF150,0*3F, and the flow will resume with “OK to send” message - $PSRF150,1*3E

FIGURE 11 – Signal View Window

FIGURE 12 – Debug View Window
14. SWITCHING FROM LOW POWER MODE TO FULL POWER MODE

14.1. BACKGROUND

The default operation mode of OriginGPS module is Full Power. The module will work in Full Power until it receives a command to switch to low power mode. Once the module is in a low power mode – it is possible to send a command to switch the module back to Full Power. Please notice: When the module is in Hibernate/Standby phase of low power – it will not receive any software commands. The module can be woken either by hardware or by software command only while it is in the Full Power phase of the low power mode.

14.2. DEMONSTRATION – SWITCHING FROM LOW POWER MODE TO FULL POWER IN SIRFLIVE SOFTWARE

Repeat stages A to L from section 12.1 - SIRFLIVE TOOL OVERVIEW.
Select the Full Power in the Power Mode window:

![Power Mode Window](image)

Figure 13 – Switching to Full Power

Press the O.K. button.

Please notice: While in a low power mode, the module switches between Full Power and Hibernate/Standby modes. While in Hibernate/Standby – the module cannot receive commands. If immediate position fix is needed during the cycle of low power mode – the module should be awakened by hardware- toggling the On_Off pad.

15. ENTERING LOW POWER MODE – FLOW CHART

15.1. PROCESS OF ENTERING LOW POWER MODE AFTER POWER ON

In order to enter a low power mode, it is necessary to:

a. Operate in a high signal level
b. Pass the Acquisition stage and enter into tracking.
c. Switch communication protocol to OSP.

The following flow chart describes the process from powering On the module till entering a Low Power Mode.

FIGURE 14 – Entering Low Power Mode Flow Chart
16. NMEA AND OSP MESSAGES

16.1. Switching from NMEA to OSP Protocol
Send SetSerialPort - Message ID 100: SetSerialPort

This message is sent from the host processor to the receiver to set the protocol (SiRF binary or NMEA) and/or the communication parameters (Baud rate, data bits, stop bits, and parity).
Example: $PSRF100,0,115200,8,1,0*04

<table>
<thead>
<tr>
<th>Name</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID</td>
<td>$PSRF100</td>
<td>PSRF100 protocol header</td>
</tr>
<tr>
<td>Protocol</td>
<td>0</td>
<td>0=SiRF binary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1=NMEA</td>
</tr>
<tr>
<td>Baud rate</td>
<td>115200</td>
<td>1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200</td>
</tr>
<tr>
<td>Data Bits</td>
<td>8</td>
<td>8 only</td>
</tr>
<tr>
<td>Stop Bits</td>
<td>1</td>
<td>1 only</td>
</tr>
<tr>
<td>Parity</td>
<td>0</td>
<td>0=None only</td>
</tr>
<tr>
<td>Checksum</td>
<td>*04</td>
<td>End of message termination</td>
</tr>
</tbody>
</table>

TABLE 3 – MESSAGE ID 100: SetSerialPort

16.2. Set Push-To-Fix Mode – Message ID 218,6

This OSP message is sent from the host processor to the receiver. It sets the module to Push To Fix mode. Before sending this message to the receiver make sure the module is in full power mode, and the protocol is OSP.
Example: A0 A2 00 2A DA 06 01 00 00 00 00 3C 00 01 00 06 00 78 00 00 00 00 00 00 00 00 00 00 00 00 02 04 B0 B3

<table>
<thead>
<tr>
<th>Name</th>
<th>Bytes</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Sequence</td>
<td>2</td>
<td>0xA0 0xA2</td>
<td>42 bytes</td>
</tr>
<tr>
<td>Payload length</td>
<td>2</td>
<td>0x00 0x2A</td>
<td>42 bytes</td>
</tr>
<tr>
<td>MID</td>
<td>1</td>
<td>0xDA</td>
<td>Decimal MID 218</td>
</tr>
<tr>
<td>SID</td>
<td>1</td>
<td>0x06</td>
<td>Decimal SID 6</td>
</tr>
<tr>
<td>Power Mode</td>
<td>1</td>
<td>0x01</td>
<td>0 = Full Power Mode&lt;br&gt;1 = Low Power Mode</td>
</tr>
<tr>
<td>Power Feature List</td>
<td>1</td>
<td>0x00</td>
<td>0 – Disabled. Not relevant.</td>
</tr>
<tr>
<td>Version</td>
<td>1</td>
<td>0x00</td>
<td>Reserved, set to 0</td>
</tr>
<tr>
<td>Rate Upper</td>
<td>1</td>
<td>0x00</td>
<td>Upper byte of low power mode rate, in seconds. When Low power mode is set, navigation solution reporting rate in seconds is calculated per equation: LPM rate = RateUpper*216 + RateLower</td>
</tr>
<tr>
<td>Rate Lower</td>
<td>2</td>
<td>0x00 0x3C</td>
<td>Lower 2 bytes of low power mode rate, in seconds. 60 seconds in this example</td>
</tr>
<tr>
<td>Use Mask</td>
<td>2</td>
<td>0x00 0x01</td>
<td>Mask bitmap. Bit 0 = 1 Override LPM defaults and set the override settings</td>
</tr>
<tr>
<td>Table 4 – MESSAGE ID 218,6: Set Push-To-Fix Mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Max Search Time | 2 | 0x00 0x06 | Maximum search time in seconds for satellites in TP and PTF.  
|                 |    |           | 0 = Max search time disabled and module will attempt to reacquire continuously.  
|                 |    |           | >0 = The actual time in seconds.  
|                 |    |           | In this example – 6 seconds.  |
| Max Off Time    | 2 | 0x00 0x78 | Maximum time for sleep mode (in seconds) between acquisition attempts in TP and PTF.  
|                 |    |           | Note: When specifying a longer interval for update rate, the maxSearchTime should also be increased.  
|                 |    |           | In this example: 120 seconds.  |
| Micro Power TimeOut | 1 | 0x00 | Not relevant for Trickle Power  |
| Micro Power Control | 1 | 0x00 | Not relevant for Trickle Power  |
| Reserved        | 4 | 0x00 0x00 0x00 0x00 | Reserved, set to 0  |
| Trickle Power RF On Time | 2 | 0x00 0x64 | This is the amount of time, in 100 ms intervals for RF to be on to acquire and track the signal before creating a measurement; range 100-800.  
|                 |    |           | In this example: 100ms.  |
| Reserved        | 2 | 0x00 0x00 | Reserved, set to 0  |
| PTF User Options| 1 | 0x00 | Push to fix options  
|                 |    |           | Bit 0: Run Shorter PTF Rate when Velocity detected  
|                 |    |           | 0 = Default PFT Rate when velocity detected  
|                 |    |           | 1 = Velocities > 5 m/s change update rate.  
|                 |    |           | See OSP extension manual for full information.  |
| Num Q Words     | 1 | 0x04 | Set to 4  |
| ReservedQWords  | 16| 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 | Reserved, set to 0  |
| CheckSum        | 2 | 0x02 0x04 |  |
| End Sequence    | 2 | 0xB0 0xB3 |  |
### 16.3. Set TricklePower Mode - Message ID 218,6

This message replaces previous Low Power OSP messages MID 218,0, MID 218,2, MID 218,3 and MID 218,4 by combining all the feature selections into a single, integrated message. Two modes are available: Full Power Mode (FPM) and Low Power Mode (LPM).

Example:  
```
A0 A2 00 2A DA 06 01 00 00 00 00 05 00 00 00 00 78 00 1E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 E4 B0 B3
```

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<td>Decimal MID 218</td>
</tr>
<tr>
<td>SID</td>
<td>1</td>
<td>0x06</td>
<td>Decimal SID 6</td>
</tr>
<tr>
<td>Power Mode</td>
<td>1</td>
<td>0x01</td>
<td>0 = Full Power Mode &lt;br&gt;1 = Low Power Mode</td>
</tr>
<tr>
<td>Power Feature List</td>
<td>1</td>
<td>0x00</td>
<td>0 – Disabled. Not relevant.</td>
</tr>
<tr>
<td>Version</td>
<td>1</td>
<td>0x00</td>
<td>Reserved, set to 0</td>
</tr>
<tr>
<td>Rate Upper</td>
<td>1</td>
<td>0x00</td>
<td>Upper byte of low power mode rate, in seconds. When Low power mode is set, navigation solution reporting rate in seconds is calculated per equation: LPM rate = RateUpper*2^{16} + RateLower</td>
</tr>
<tr>
<td>Rate Lower</td>
<td>2</td>
<td>0x00 0x05</td>
<td>Lower 2 bytes of low power mode rate, in seconds. 5 seconds in this example</td>
</tr>
<tr>
<td>Use Mask</td>
<td>2</td>
<td>0x00 0x00</td>
<td>Mask bitmap. See OSP extension manual for full information.</td>
</tr>
<tr>
<td>Max Search Time</td>
<td>2</td>
<td>0x00 0x78</td>
<td>Maximum search time in seconds for satellites in TP and PTF. 0 = Max search time disabled and module will attempt to reacquire continuously. &gt;0 = The actual time in seconds. In this example: 120 seconds</td>
</tr>
<tr>
<td>Max Off Time</td>
<td>2</td>
<td>0x00 0x1E</td>
<td>Maximum time for sleep mode (in seconds) between acquisition attempts in TP and PTF. Note: When specifying a longer interval for update rate, the maxSearchTime should also be increased. In this example: 30 seconds</td>
</tr>
<tr>
<td>Micro Power TimeOut</td>
<td>1</td>
<td>0x00</td>
<td>Not relevant for Trickle Power</td>
</tr>
<tr>
<td>Micro Power Control</td>
<td>1</td>
<td>0x00</td>
<td>Not relevant for Trickle Power</td>
</tr>
<tr>
<td>Reserved</td>
<td>4</td>
<td>0x00 0x00 0x00 0x00</td>
<td></td>
</tr>
<tr>
<td>Trickle Power RF On Time</td>
<td>2</td>
<td>0x00 0x64</td>
<td>This is the amount of time, in 100 ms intervals for RF to be on to acquire and track the signal before creating a measurement; range 100-800. In this example: 100ms.</td>
</tr>
</tbody>
</table>
### 16.4. Transition to Full Power Mode Request- Message ID 218, Sub ID 6

This OSP message is sent from the host processor to the receiver, to exit from a Low Power mode to Full Power.

Example:  
```
A0 A2 00 2A DA 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 E4 B0 B3
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Bytes</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Sequence</td>
<td>2</td>
<td>0xA0 0xA2</td>
<td></td>
</tr>
<tr>
<td>Payload length</td>
<td>2</td>
<td>0x00 0x2A</td>
<td>42 bytes</td>
</tr>
<tr>
<td>MID</td>
<td>1</td>
<td>0xDA</td>
<td>Decimal MID 218</td>
</tr>
<tr>
<td>SID</td>
<td>1</td>
<td>0x06</td>
<td>Decimal SID 6</td>
</tr>
</tbody>
</table>
| Power Mode                | 1     | 0x00          | 0 = Full Power Mode  
1 = Low Power Mode        |
| Power Feature List        | 1     | 0x00          | 0 – Disabled. Not relevant.                      |
| Version                   | 1     | 0x00          | Reserved, set to 0                               |
| Rate Upper                | 1     | 0x00          | Upper byte of low power mode rate, in seconds.  
Not relevant for full power. |
| Rate Lower                | 2     | 0x00 0x00     | Lower 2 bytes of low power mode rate, in seconds. 
Not relevant for full power. |
| Use Mask                  | 2     | 0x00 0x00     | Mask bitmap.  
Not relevant for full power. |
<p>| Max Search Time           | 2     | 0x00 0x00     | Maximum search time in seconds for satellites in TP and PTF. Not relevant for full power. |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Length</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Off Time</td>
<td>2</td>
<td>0x00 0x00</td>
<td>Maximum time for sleep mode (in seconds) between acquisition attempts in TP and PTF. Not relevant for full power.</td>
</tr>
<tr>
<td>Micro Power TimeOut</td>
<td>1</td>
<td>0x00</td>
<td>Not relevant for full power.</td>
</tr>
<tr>
<td>Micro Power Control</td>
<td>1</td>
<td>0x00</td>
<td>Not relevant for full power.</td>
</tr>
<tr>
<td>Reserved</td>
<td>4</td>
<td>0x00 0x00 0x00 0x00</td>
<td></td>
</tr>
<tr>
<td>Trickle Power RF On Time</td>
<td>2</td>
<td>0x00 0x00</td>
<td>Not relevant for full power.</td>
</tr>
<tr>
<td>Reserved</td>
<td>2</td>
<td>0x00 0x00</td>
<td>Reserved, set to 0</td>
</tr>
<tr>
<td>PTF User Options</td>
<td>1</td>
<td>0x00</td>
<td>Push to fix options – not relevant, set to 0</td>
</tr>
<tr>
<td>Num Q Words</td>
<td>1</td>
<td>0x04</td>
<td>Set to 4</td>
</tr>
<tr>
<td>ReservedQWords</td>
<td>16</td>
<td>0x00 0x00 0x00 0x00 0x00</td>
<td>Reserved, set to 0</td>
</tr>
<tr>
<td>CheckSum</td>
<td>2</td>
<td>0x00 0xE4</td>
<td></td>
</tr>
<tr>
<td>End Sequence</td>
<td>2</td>
<td>0xB0 0xB3</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 6 – MESSAGE ID 218,6: SET FULL POWER MODE**