

## SATELLINE-3AS and SATELLINE-M3 Radio Modem Family Pacific Crest/TRIMTALK compatibility (Radio Compatibility Options 1, 2, 3)

### 1. General

SATELLINE-3AS(d) radio modems support additional to the original SATEL 3AS data transfer also:

- Pacific Crest compatible data transfer over the air, if the opponent Pacific Crest modems operate in the transparent mode/FEC ON/Scrambling ON that is the most common setup among RTK applications. The other modes are currently not supported.
- TRIMTALK® 450s compatible data transfer over the air.

SATELLINE-3AS(d) radio modems provide the following radio compatibility settings:

- Option 1 for Pacific Crest 4-FSK modulation, Transparent mode/FEC ON/Scrambling ON.
- Option 2 for Pacific Crest GMSK modulation, Transparent mode/FEC ON/Scrambling ON.
- Option 3 for TRIMTALK GMSK modulation, Transparent mode

So far, only the transparent mode is implemented, since it is the most commonly used and recommended by the user manuals. The ARQ based protocols with ACK/NACK schemes are not preferred in RTK applications that apply one-way communication.

The implementation of Options 1, 2, 3 is based on the reference measurements and the available public data of the following radio modems manufactured by Pacific Crest Corporation: RFM96W, PDL HPB, PDL LPB. TRIMTALK is a trademark of Trimble Navigation Ltd.

### 2. Hardware requirements

The Pacific Crest compatibility feature requires the correct hardware variant. Please check for the available models from SATEL that are at the moment:

- SATELLINE-3AS(d) ("Pacific Crest/TRIMTALK Compatible" must be indicated in purchase orders)
- SATELLINE-3ASm/LC
- SATELLINE-3ASd Epic Pro 35W
- SATELLINE-M3-T1
- SATELLINE-M3-R1
- SATELLINE-M3-TR1
- Most OEM-models manufactured 2009 or later have Pacific Crest support readily in their hardware.

Pacific Crest/TRIMTALK compatible SATELLINE-3AS Epic(d) 10W hardware will be released Q1/2010.

Note:

SATELLINE-3AS(d) based hardware models have a fixed channel spacing of 25 kHz, 20 kHz or 12.5 kHz that may limit the applicability of the radio compatibility options in mixed use.  
SATELLINE-M3-TR1, -M3-R1 and -M3-T1 have adjustable channel spacing (12.5/20/25 kHz).

Note on SATELLINE-3AS(d) and SATELLINE-3AS(d) Epic 10W models:

The "E2-PF" marking on the serial number label indicates the Pacific Crest/TRIMTALK compatible hardware.

Depending on the model, previously manufactured SATELLINE-3AS(d) radio modems (with "E2" marking, and many of OEM models) can be reworked to Pacific Crest compatible at SATEL's service - contact SATEL for further information.

SATELLINE-3AS NMS/VHF modems shall not provide any Pacific Crest compatible support.

### 3. Firmware support

The firmware versions starting from the version 3.39 provide the Pacific Crest/TRIMTALK compatibility feature using the above listed hardware models. The repeater function is also supported.

The firmware versions 3.33 up to 3.37 provide the Pacific Crest compatibility feature using the above listed hardware models but with no support for TRIMTALK, repeater function or Pacific Crest addressing.

The firmware operates in any one of the compatibility modes that are supported by the actual hardware and the factory settings.

### 4. Configuration in the Programming menu

The correct radio compatibility mode can be activated by selecting the desired option in the *Radio settings->Radio compatibility Mode* submenu in the programming mode.

```
Radio compatibility Mode
-----
1) Satel 3AS
2) Option 1   (Pacific Crest 4-FSK)
3) Option 2   (Pacific Crest GMSK)
4) Option 3   (TRIMTALK GMSK)
```

In case the requested mode is not supported, the modem replies:

```
"This compatibility mode is not available
in this hardware version. "
```

## 5. Configuration by using SL commands

"SL@S=" command selects the compatibility mode:

- "SL@S=0" sets Satel 3AS (default).
- "SL@S=1" sets Option1 (Pacific Crest 4-FSK)
- "SL@S=2" sets Option 2 (Pacific Crest GMSK)
- "SL@S=3" sets Option 3 (TRIMTALK GMSK)

The modem responds with "OK" message if the requested mode is supported, or "ERROR" if the mode is not allowed.

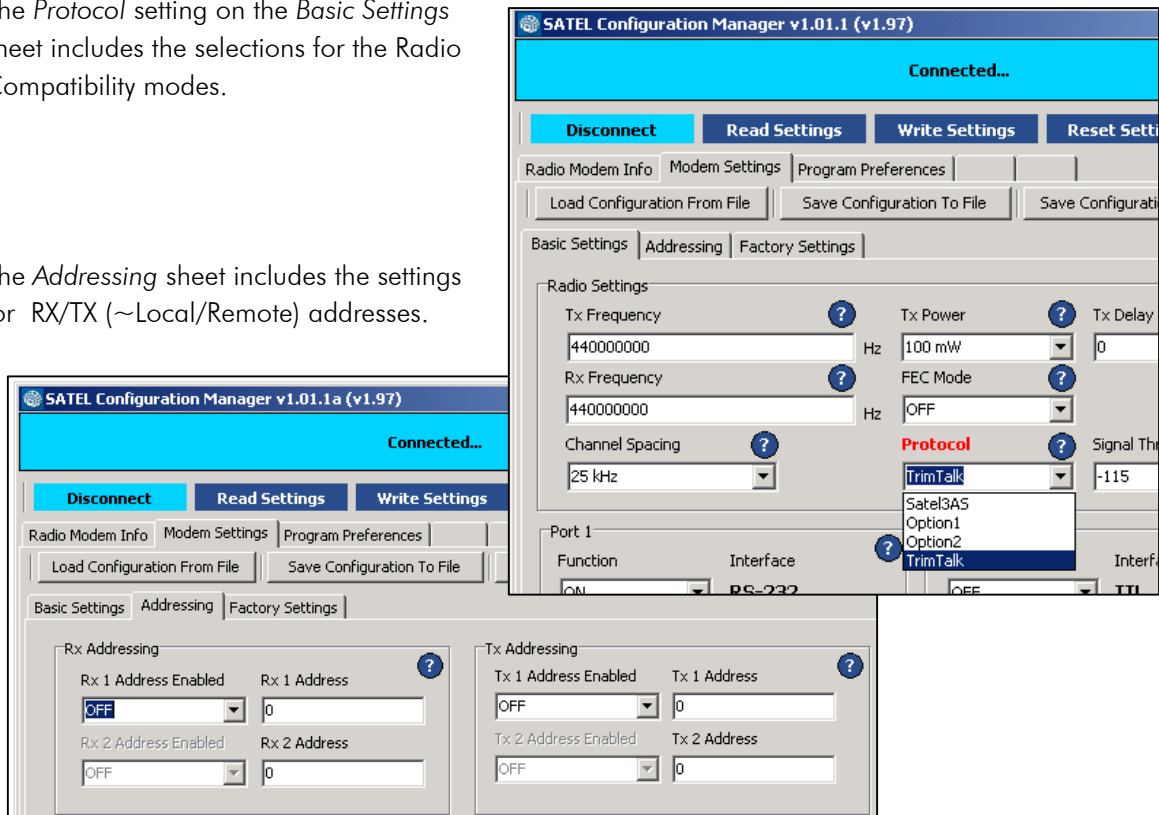
"SL@S?" enquires the active mode. The modem responds with a number:

- "0" if the mode is Satel 3AS
- "1" if the mode is Option 1
- "2" if the mode is Option 2
- "3" if the mode is Option 3

## 6. Configuration by using SATEL Configuration Manager PC software

The *Protocol* setting on the *Basic Settings* sheet includes the selections for the Radio Compatibility modes.

The *Addressing* sheet includes the settings for RX/TX (~Local/Remote) addresses.



## 7. Settings

In order to use the Pacific Crest/TRIMTALK modes implemented in SATELLINE modems:

PACIFIC CREST modems must have:

- *Protocol Mode* =
  - *Transparent w/EOT Timeout* (when using Pacific Crest modulations)
  - *TrimTalk 450s* (when using TRIMTALK GMSK modulation)
- *Modulation Type* depends on the system
  - *GMSK* (default, always selected when using TRIMTALK 450s mode)
  - *4-Level-FSK*
- *FEC* = ON
- *Scrambling* = ON
- *Data Security Code* set to = 0 (=not used)
- *Local Address*= 0...254 (0 by default)  
Pacific Crest modem receives messages from SATELLINE modems that have their *TX1 address* matching the *Local Address*.
- *Remote address*=0...255 (255 by default, that is the broadcast address to be received by all) SATELLINE modems receive the message from a Pacific Crest radio, provided their *RX1 address* matches the *Remote Address* of a Pacific Crest transmitter (or if the message has the broadcast address 255).

SATELLINE modems must have the following key settings:

- *FEC* OFF (because the *FEC* here means SATEL 3AS *FEC*, not Pacific Crest/TRIMTALK *FEC* )
  - *Error check* OFF
  - *Full CRC16 check* OFF
  - *Radio Compatibility Option 1* in case of Pacific Crest 4-FSK
  - *Radio Compatibility Option 2* in case of Pacific Crest GMSK
  - *Radio Compatibility Option 3* in case of TRIMTALK GMSK
  - *Addressing*:
    - When *TX address* is selected ON, then *TX1 address* is used like *PDL Remote address* that is the destination address for the transmitted messages.  
Default value is 0x00FF (=255) (note the hexadecimal format of the setting)
    - When *RX Address* is selected ON, then *RX1 address* is used like *PDL Local address*  
Default value is 0x0000 (=0) (note the hexadecimal format of the setting)
- Note: Addresses are NOT applicable in TRIMTALK 450s mode so SATELLINE modems must have their RX/TX addresses OFF with Option3.*

The configuration tools and settings are different between SATELLINE and Pacific Crest modems:

- Pacific Crest modems are configured via the serial port using *PDLCONF* Windows™ program that sends binary control messages to the serial port of the modem.
- SATELLINE-3AS and SATELLINE-M3 radio modems are configured via the serial port using any ordinary terminal program or *SATEL Configuration Manager* PC-program.

The table on the next page shows the analogy of settings between Pacific Crest and SATELLINE radio modems.

**Table 7.1. Analogy of the settings between Pacific Crest and SATELLINE radio modems**

<i>Pacific Crest setting</i>	<i>Corresponding SATELLINE setting</i>
Identification: Call Sign	Implemented only in SATELLINE-3ASd Epic Pro 35W
Identification: Owner	(not implemented)
Identification: Channel Bandwidth	Channel spacing
Identification: Power	TX power
Radio Link: Channel Selection Type (Manual)	Radio frequency
Radio Link: Current Channel	Radio frequency
Radio Link: Link Rate	The fixed link rates are: Option 2 & 3: 9600bps@25kHz / 4800bps@12.5kHz Option 1: 19200bps@12.5kHz / 9600bps@12.5kHz
Radio Link:Modulation Type	Compatibility->Option 1 (=Pacific Crest 4-FSK) Compatibility->Option 2 (=Pacific Crest GMSK) Compatibility->Option 3 (=TRIMTALK GMSK)
Radio Link:Scrambling	ON by default
Radio Link:Transmit Retries	(not implemented)
Radio Link:TX ACK Timeout	(not implemented)
Radio Link:CSMA Monitoring	Priority (RX=ON, TX=OFF) Default: RX
Radio Link: AutoBase/AutoRover	(not implemented)
Radio Link:Digisquelch	Signal threshold
Radio Link:Forward Error Correction	ON by default using Options 1,2,3 (Note: SATELLINE-3AS FEC must be OFF!)
Radio Link:Local Address (0 by default)	Primary RX address (RX1) (OFF by default)
Radio Link:Remote Address (255 by default)	Primary TX address (TX1) (OFF by default)
Serial Interface:Protocol Mode	Radio compatibility: Options 1 and 2 = Transparent w/EOT Timeout Option 3 = TRIMTALK 450s
Serial Interface:BREAK to Command	(not implemented)
Serial Interface:Modem Enable: Yes	(not applicable)
Serial Interface:Soft Break Enable	(not implemented)
Serial Interface:EOT value (in 0.01s units)	Pause length (in serial port byte intervals)
Serial Interface:Digipeater Delay(in0.01s units)	(not implemented)
Serial Interface:Local Node Repeater	(not implemented)
Frequency Table	Radio frequency
Data Security Code (must be 0=not used)	(not implemented)
Potential conflicts:	
<ul style="list-style-type: none"> <li>• Pacific Crest Local/Remote addresses are supported in the firmware versions starting from v3.39</li> <li>• Repeater function is supported only in the firmware versions starting from v3.39</li> <li>• Error check and Full CRC16 check must be OFF in SATELLINE modem</li> <li>• FCS (Free Channel Scanning) feature is not supported by Pacific Crest radios</li> <li>• Message Routing is not supported by Pacific Crest radios</li> <li>• SATELLINE RX/TX addressing does not use ARQ scheme like Pacific Crest radios.</li> </ul>	

## 8. Repeater function

The implemented Pacific Crest/TRIMTALK modes support also the repeater function. The repeater function is configured either by using the SL commands:

"SL@M=R" (Repeater ON)

"SL@M=O" (Repeater OFF)

or by selecting *Repeater OFF/ON* in the *Additional setup-> Repeater* programming menu.

*Note 1.* The repeater modem passes TRIMTALK messages also to its serial port unlike for example Pacific Crest PDL modems.

*Note 2.* SATELLINE-3AS(d) Epic-modems do NOT support the DIVERSITY reception in TRIMTALK mode, consequently the *Diversity* setting must be OFF.

*Note 3.* If error correction is ON (*FEC ON*) and TRIMTALK mode is activated by using "SL@S=3" command, the firmware automatically switches SATEL FEC OFF temporarily, and turns it back at the mode return.

## 9. Support for Local/Remote addresses in Pacific Crest compatibility modes

If the modem has TX address ON then primary TX address is handled in the same way as Remote address in Pacific Crest PDL modems. The default value is 0x00FF (255 in decimal format) i.e. the broadcast address.

If the modem has RX address ON then primary RX address is handled in the same way as PDL Local address in Pacific Crest PDL modems. The default value is 0x0000 (0 in decimal format).

SATELLINE modem needs to have TX Delay 50ms or more in order to avoid messages from colliding in case it is to be placed in a Pacific Crest system that uses addressing and acknowledging scheme.

In case only broadcast messages are used (like in RTK applications) there is usually no need for TX Delay, except if the transfer delays identical to Pacific Crest modems are preferred – in such cases an appropriate value of TX Delay is 34 ms.

*Note 1.* SATELLINE-modems do not support Pacific Crest retransmit/acknowledge scheme. However, that has no effect in RTK applications because they utilize only broadcast messages.

*Note 2.* SATELLINE-3AS(d) Epic-modems do NOT support the diversity reception in Pacific Crest modes. Consequently the *Diversity* setting must be OFF.

## 10. Latency

In the Pacific Crest Transparent protocol mode (Option 1 and Option 2) the whole message is first read from the serial port and after that it will be framed and transmitted over the radio.

The end of the message is detected when there is a pause in data coming from the serial port.

The bit rates for the Pacific Crest 4-FSK (Option1) are:

- 19200bps on 25kHz channel
- 9600bps on 12.5kHz channel

The bit rates for the Pacific Crest GMSK (Option2) are:

- 9600bps on 25kHz channel
- 4800bps on 12.5kHz channel

The actual raw data rate is appr. 2/3 of the symbol rate.

### 10.1 Transmission delays using Option1 (Pacific Crest 4-FSK) on 25kHz channel

The table below presents the typical latency vs. the size of the message. The delays are measured from the end of transmitted data to the end of received data on the serial interface.

Number of bytes sent

Bps	1	10	100	500
1200	77 ms	159 ms	971 ms	4590 ms
4800	48 ms	68 ms	317 ms	1438 ms
9600	43 ms	52 ms	209 ms	912 ms
19200	40 ms	45 ms	154 ms	650 ms
38400	39 ms	41 ms	127 ms	519 ms

### 10.2 Transmission delays using Option2 (Pacific Crest GMSK) on 25kHz channel

The table below presents the typical latency vs. the size of the message. The delays are measured from the end of transmitted data to the end of received data on the serial interface.

Number of bytes sent

Bps	1	10	100	500
1200	86 ms	168 ms	1042 ms	4949 ms
4800	57 ms	77 ms	390 ms	1796 ms
9600	52 ms	62 ms	281 ms	1272 ms
19200	50 ms	55 ms	226 ms	1009 ms
38400	48 ms	51 ms	198 ms	878 ms