

## SATELLINE-3AS radio modems and PCC compatibility (Radio Compatibility Option1 and Option2)

### 1. General

SATELLINE-3AS(d) radio modems support PCC (Pacific Crest) compatible data transfer over the air, if the opponent PCC 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.

SATELLINE-3AS(d) radio modems provide the radio compatibility settings *Option 1* and *Option 2*:

- Option 1 is for PCC-4FSK modulation, Transparent mode/FEC ON/Scrambling ON.
- Option 2 is for PCC-GMSK modulation, Transparent mode/FEC ON/Scrambling ON.

So far, only the transparent mode is implemented, since it seems to be 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 the feature is based on the reference measurements and the available public data of the following radio modems manufactured by Pacific Crest: RFM96W, PDL HPB, PDL LPB.

### 2. Hardware requirements

The PCC compatibility feature requires the correct hardware variant. The models that are available in the first phase are (the list will be accomplished during 2009):

- SATELLINE-3AS (“PCC Compatible” must be indicated in the customer’s order)
- SATELLINE-3ASd (“PCC Compatible” must be indicated in the customer’s order)
- SATELLINE-3ASm/LC (“PCC Compatible” must be indicated in the customer’s order)
- Most OEM-models manufactured 2009 or later have PCC support readily in their hardware.

The “E2-PF” marking on the s/n label of SATELLINE-3AS and 3ASd indicates the PCC 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 PCC compatible at Satel’s service - contact Satel for further information.

Note that SATELLINE-3AS NMS/VHF modems shall not provide any PCC support.

### 3. Software support

The software versions starting from the version 3.33 provide the PCC compatibility feature using the above listed hardware models. The software 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 changed in the Programming mode submenu *Radio settings* ->*Radio compatibility Mode*:

```
Radio compatibility Mode
-----
1) Satel 3AS
2) Option 1   (PCC 4-FSK)
3) Option 2   (PCC 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 Option 1 (PCC-4FSK)
- "SL@S=2" sets Option 2 (PCC-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



## 6. Settings

For PCC Transparent mode to work, the PacCrest modems must have:

- Protocol mode set to *transparent*
- *FEC* ON
- *Scrambling* ON
- Data Security Code set to 0 (=not used)
- Local Address=0
- Remote address=255

And the 3AS modems must have:

- Radio Compatibility Option 1 in case of PCC-4FSK
- Radio Compatibility Option 2 in case of PCC-GMSK
- FEC OFF (because the FEC here means Satel's FEC, not PCC)
- RX/TX addresses OFF
- Error check OFF
- Full CRC16 check OFF

Additional compatible combinations can be implemented in the modem software depending on the market needs.

The configuration tools and settings are different between Satel and PacCrest modems:

- PacCrest 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 modems are configured via the serial port using either any ordinary terminal program or Satel Configuration Manager PC-program.

The table on the next page shows the analogy of the settings between PCC and SATEL radio modems.



**Table 6.1. Analogy of the settings between PCC and SATEL radio modems**

<i>PCC setting</i>	<i>Corresponding SATELLINE-3AS setting (status in software version 3.33)</i>
Identification: Call Sign	(not implemented)
Identification: Owner	(not implemented)
Identification: Channel Bandwidth	Channel spacing
Identification: RF Power	TX power
Radio Link: Channel Selection Type (Manual)	Radio frequency
Radio Link: Current Channel	Radio frequency
Radio Link: Link Rate	Fixed rate: 19200/4FSK or 9600/GMSK
Radio Link:Modulation Mode	Compatibility->Option 1 (=PCC-4FSK) Compatibility->Option 2 (=PCC-GMSK)
Radio Link:Scrambling	ON by default using Option 1 and Option 2
Radio Link:Transmit Retries	(not implemented)
Radio Link:TX ACK Timeout	(not implemented)
Radio Link:Cdma 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 Option 1 and Option 2 (Note: SATELLINE-3AS FEC must be OFF!)
Radio Link:Local Address (0 by default)	(not implemented)
Radio Link:Remote Address (255 by default)	(not implemented)
Serial Interface:Protocol Mode	Compatibility->Option 1 and Option 2 operate Transparent w/EOT Timeout by default
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>• Repeater stations are not supported</li> <li>• Error check and Full CRC16 check must be OFF in Satel modem</li> <li>• FCS is not supported by PCC Transparent mode radio frame</li> <li>• Message Routing is not supported by PCC Transparent mode radio frame</li> <li>• Satel RX/TX addressing must be OFF (PCC addressing means ARQ)</li> </ul>	



## 7. Latency

In the PCC 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 symbol rates for the PCC-4FSK (Option1) are:

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

The symbol rates for the PCC-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.

### 7.1 Transmission delays using Option1 (PCC-4FSK) on 25 kHz 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

### 7.2 Transmission delays using Option2 (PCC-GMSK) on 25 kHz 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