User Guide

Version 1.0

SATELLINE-3AS/TC

Radio Data Modem Module

as an Annex to SATELLINE-3AS User Guide version 2.5

RESTRICTIONS ON USE

SATELLINE-3AS radio modems have been designed to operate on frequency ranges, the exact use of which differs from one region and/or country to another. The user of a radio modem must take care that the said device is not operated without the permission of the local authorities on frequencies other than those specifically reserved and intended for use without a specific permit.

SATELLINE-3AS/TC is allowed to be used in the following countries, either on licence free channels or on channels where the operation requires a licence. More detailed information is available at the local frequency management authority.

Countries*: AT, BE, BG, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IS, IE, IT, LV, LT, LU, MT, NL, NO, PL, PT, RO, SK, SI, ES, SE, CH, TR, GB and US

WARNING! Users of SATELLINE-3AS/TC radio modems in North America should be aware, that due to the allocation of the frequency band 406.0 – 406.1 MHz for government use only, the use of radio modem on this frequency band without a proper permit is strictly forbidden.

* codes of the countries follow the ISO 3166-1-Alpha-2 standard

PRODUCT CONFORMITY

SATELLINE-3AS/TC

Hereby, SATEL Oy declares that SATELLINE-3AS/TC radio modem is in compliance with the applicable essential requirements (Article 3.2) and other relevant provisions of Directive 1999/5/EC.* Therefore the equipment is labelled with the following CE-marking. The notification sign informs user that the operating frequency range of the device is not harmonised throughout the market area, and the local spectrum authority should be contacted in prior of use.

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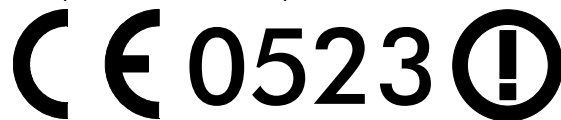
* The conformity to EMC and Safety requirements (Article 3.1(a)-(b)) of the Directive 1999/5/EC shall be declared by the original equipment manufacturer in the final device assembly.

TABLE OF CONTENTS

1 INTRODUCTION

SATELLINE-3AS/TC is a member of the versatile SATELLINE-3AS radio modem family. Consisting of a data modem and a UHF radio transceiver, it provides a wireless, transparent and half-duplex serial data link with other similar radio modules or compatible SATELLINE radio modems manufactured by SATEL Oy.

SATELLINE-3AS/TC is designed for integration into the terminal equipment. The component blocks are shielded by metal plates, but the housing and the related mechanics are supplied by the client. Also the EMC characteristics of the radio module are completed for the combined equipment.

A number of new SL commands has been implemented to the modem controller software for full control of the features of SATELLINE-3AS/TC in integrated use.

The implementation of SATELLINE-3AS/TC is based on the widely used SATELLINE-3AS radio modem – the radio communication and the user interface are similar. The main differences to SATELLINE-3AS are:

1. SATELLINE-3AS/TC is delivered without the housing – only the two PCBs (the logic board and the RF board shielded as a one card) are supplied by SATEL
2. Antenna connector is a female MMCX connector.
3. The antenna circuitry of the radio module includes an additional filter on GPS frequencies in order to avoid any interference to the GPS receivers.
4. The main header is a 32-pin Eurocard connector type B.
5. The operating voltage must be 6.5V…18VDC.

SATELLINE-3AS/TC has two pins in the header connector for controlling the external LED indicators, the one for the external green LED and the other for the red LED. By different combination of the LED status, the user of the application device can monitor the status of the SATELLINE-3AS/TC radio module.

2 TECHNICAL SPECIFICATIONS

SATELLINE-3AS/TC complies with the following international standards:

- EN 300 113

RADIO TRANSCEIVER	
Frequency Range	380...470 MHz
Channel Spacing	12.5 kHz/25 kHz
Number of Channels	160 / 80 or (2 x 160 / 2 x 80)
Frequency Stability	$< \pm 1.5$ kHz
Type of Emission	F1D
Communication Mode	Half-Duplex
RADIO TRANSMITTER	
Carrier Power	10 mW...1 W / 50 Ω
Carrier Power Stability	+ 2 dB / - 3 dB
Adjacent Channel Power	according to EN 300 113
Spurious Radiations	according to EN 300 113
RADIO RECEIVER	
Sensitivity	- 116... –110 dBm (BER < 10 E-3) depending on Receiver settings
Common Channel Rejection	> - 12 dB
Adjacent Channel Selectivity	> 60 dB @ 12.5 kHz, > 70 dB @ 25 kHz
Intermodulation Attenuation	> 65 dB
Spurious Radiations	< 2 nW
MODEM	
Interface	RS-232
Interface Connector	32-pin Eurocard connector type B
Data Speed of Serial Interface	1200 – 38400 bps
Data Speed of Radio Interface	19200 bps (25 kHz channel) / 9600 bps (12.5 kHz channel)
Data format	Asynchronous RS-232
GENERAL	
Operating Voltage	+6.0...+14.0 V_{DC}
Power Consumption (average)	1.7 VA (Receive) 5.5 VA (Transmit) 0.05 VA (in *Standby Mode*)
Operating Temperature Range	-25 °C...+55 °C
Vibration	Not specifed
Antenna Connector	MMCX, 50 Ω, female
Housing	SATELLINE-3AS/TC is delivered without the housing. The component blocks on the PCB are covered by metal shields
Size H x W x D	13 x 100 x 123.5 mm
Weight	140 g

3 USER INTERFACE

The user interface of SATELLINE-3AS/TC is basically similar to the standard SATELLINE-3AS radio modem – the data handling, configuration or the control of the device.

The user guide of SATELLINE-3AS raio modem provides the detailed functional description of SATELLINE-3AS/TC. Only the details specifically applied for SATELLINE-3AS/TC and its use in the client's system are specified in this document.

3.1 LED indicators

SATELLINE-3AS/TC has two pins (GRN_LED and RED_LED) in the header connector for controlling the external LED indicators. GRN_LED controls the external green LED and RED_LED controls the external red LED.

The radio module itself does not have any LED indicators.

The operation of the LED indicators is different in the "normal" mode and in the FCS (Free Channel Scan) mode. The operation is specified by the two tables below.

3.1.1 SATELLINE-3AS/TC – LED INDICATORS in the NORMAL MODE

LED status	Description
No light	Modem is turned off
Green flashes	Modem is in receiver mode
Solid green (non-blinking)	Radio Link established. Modem has received data within last 5 seconds
Solid green + red blinks	Modem is receiving data
Solid red	Modem is in transmitter mode
Red blinks + green blinks	Modem is in command mode

Note: In Normal operation all modems are in receiver mode by default, and red led is on only during the transmission of data.

3.1.2 SATELLINE-3AS/TC – LED INDICATORS in the FCS MODE

LED status	Description
No light	Modem is turned off
Green flashes	Modem is in receiver mode
Solid green (non-blinking)	Radio link established. Modem is ready to receive data. FCS Slave modem has found the transmitter.
Solid green + red blinks	Modem is receiving data
Solid red	Modem is in transmitter mode
Red blinks + green blinks	Modem is in command mode

Note: In FCS mode FCS master modem is always in transmitter mode.

3.2 SL commands

SATELLINE-3AS/TC accepts the same SL commands as SATELLINE-3AS. The table below lists all commands available.

3.2.1 SATELLINE-3AS – SL COMMANDS LIST

Frequency related	Effect and description of command
SL&F=nnn.nnnnn	Set frequency to nnn.nnnnn MHz
SL&F?	Display current frequency (response 'nnn.nnnnn MHz')
SL&C?	Display center frequency (response 'nnn.nnnnn MHz')
SL&+=nn	Set frequency nn channels above center frequency Frequency = Center frequency + nn * Channel spacing, where nn=[0...Number of channels/2]
SL&-=nn	Set frequency nn channels below center frequency Frequency = Center frequency – nn * Channel spacing, where nn=[0…Number of channels/2]
SL&N?	Display current frequency deviation from center frequency as channels (Frequency – Center frequency)/Channel spacing (response '+nn' or '-nn')
SL&D=x	Sets the operational mode of the radio. The different values of x are: "S" = Single Channel "D" = Dual Channel "R" = Reverse Dual Channel **Note!** Use this command only, if the setup of the frequency bands matches the Dual Channel operation.
SL&D?	Request the operational mode of the radio. The response is one of the following: "S" = Single Channel "D" = Dual Channel "R" = Reverse Dual Channel **Note!** Use this command only, if the setup of the frequency bands matches the Dual Channel operation.

Addressing related	Effect and description of command (These commands are NOT applicable in this application)
SL#I=xxxx	Set all addresses (RX1, RX2, TX1, TX2) to value xxxx
SL#I?	Display both primary addresses (TX1, RX1) (response 'xxxx;yyyy')
SL#T=xxxx	Set both transmit addresses (TX1, TX2) to value xxxx
SL#T?	Display primary transmit address (TX1) (response 'xxxx')
SL#R=xxxx	Set both receive addresses (RX1, RX2) to value xxxx
SL#R?	Display primary receive address (RX1) (response 'xxxx')
SL#P=xxxx;yyyy	Set primary transmit address (TX1) to value xxxx and receive address (RX1) to value yyyy
SL#S=xxxx;yyyy	Set secondary transmit address (TX2) to value xxxx and receive address (RX2) to value yyyy
SL#P?	Display primary transmit address (TX1) and receive address (RX1) (response 'xxxx;yyyy')
SL#S?	Display secondary transmit address (TX2) and receive address (RX2) (response 'xxxx;yyyy')
Note: xxxx and yyyy above mean address in the hexadecimal format (0000 … FFFF)	

Other radio related	Effect and description of command
SL@R?	Display field strength of the last received message (the value is an average of many measurements made during the same reception). Response "-xx dBm", where xx is a decimal value of the field strength and it is between –80 dBm and –118 dBm. Value available 7s after reception. SATELLINE-3AS Epic returns the stronger value of two receivers.
SL@P=xxxxx	Set the RF output power, where xxxxx is the decimal value of the intended power in milliwatts. If the given value does not correspond to one of the programmed power levels, the output power is set to the nearest possible value.
SL@P?	Requests the RF output power. Response "xxxxx mW", where xxxxx is a decimal value the output power of the transmitter.
SL@T=-xxx	Set the minimum power level of the signal to be received (="Signal Treshold level), where xxx is a decimal value of the new intended level in dBm.
SL@T?	Request of the current "Signal Treshold Level". Response is "-xxx dBm.

FCS related	Effect and description of command
SL!M?	Show the FCS mode of the modem. The reply is 'O' if FCS is turned OFF, 'M' for a master (=transmitter) and 'S' for the slave (=receiver).
SL!O?	Returns beacon sending disable timeout
SL!O=	Sets the beacon sending disable timeout. Time is in seconds. If it is zero then beacon is never disabled. If timeout is less than beacon timeout, modem will not send additional beacons.
SL!D?	Returns the lower limit for band 1
SL!U?	Returns the upper limit for band 1
SL!W?	Returns the lower limit for band 2
SL!Y?	Returns the upper limit for band 2

Other SL commands	Effect and description of command
SL**>	Save current settings as permanent settings
SL!V?	Returns modem type: • "3AS" • "3AS(d)" • "3AS/TC" (for the transceiver module) • "3ASrm" for receiver module.
SL%V?	Display software revision information (response 'Vn.nn')
SL+P=xxxx	Get the measured signal strength from the remote modem i.e. SL "ping". *(NOT applicable in D-GPS application)*

3.3 Free Channel Scanning feature (FCS)

A separate document describes the operation of the Free Channel Scan feature in details.
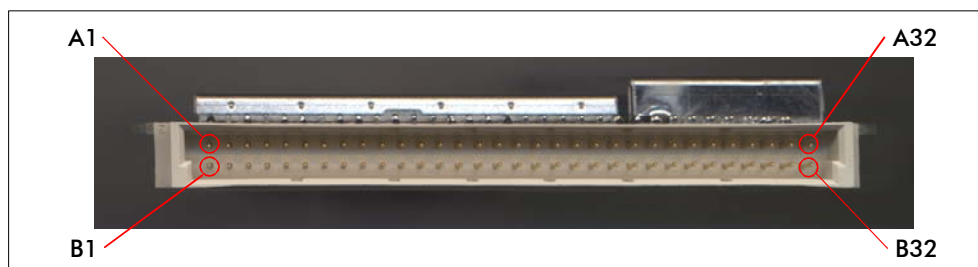
4 HEADER INTERFACE

4.1 Header Connector

SATELLINE-3AS/TC - HEADER CONNECTOR PINOUT
Type of the connector: 32-pin male Eurocard connector, type B

Pin#	Signal Name	In/Out	Level	Description
A1	GND	-	GND	
A3	PWR_ON	In	0..+14VDC	Radio modem On/Off control (OFF = 0...+0.7VDC, ON = higher than +2.0VDC).
A6	PROG	In	0..+14VDC	Must be normally UNCONNECTED or higher than +3.0 VDC Connect to ground in order to: a) access the setup menu b) update the program flash
A14	PWR_LED	Out	High Z / +5V	POWER LED anode
A15	RD_LED	Out	High Z / +5V	RD LED anode
A17	GND	-	GND	
A23	PWR_IN	In	+ 6.0..14VDC	Power Supply
A24	PWR_IN	In	+ 6.0..14VDC	Power Supply
A25	FLASH	In	0..+14VDC	Must be normally UNCONNECTED. Connected to PWR_IN in order to enter the FLASH bootmode programming.
A31	RSSI	Out	0..+4.5VDC	RSSI analog output (option)
B1	GND	-	GND	
B3	TX_A	In	RS-232	Data **FROM** terminal unit **TO** radio modem Port 1
B5	RTS_A	In	RS-232	Request To Send **FROM** terminal unit. Radio modem ignores this.
B8	RX_A	Out	RS-232	Data **TO** terminal unit **FROM** radiomodem Port 1
B9	CTS_A	Out	RS-232	Clear To Send. This signal indicates that radiomodem is ready to receive data FROM terminal unit.
B11	TX_B	In	RS-232	Data FROM Hiper TO radio modem Port 2
B13	RTS_B	In	RS-232	Request To Send **FROM** terminal unit. Radio modem ignores this.
B16	RX_B	Out	RS-232	Data TO terminal unit FROM radio modem Port 2
B17	CTS_B	Out	RS-232	Clear To Send. This signal indicates that radiomodem is ready to receive data FROM terminal unit.
B24	GND	-	GND	

Outside view of the header connector.

5 RF INTERFACE

5.1 Antenna connector

The antenna connector is a coaxial 50 ohm MMCX receptable, and it is located on the opposite side of the module than the header connector.