SLR6

Radio Modem Transceiver

User Guide

TABLE OF CONTENTS

1 IMPORTANT NOTICE

All rights to this manual are owned solely by Satel Oy (referred to in this user guide as Satel). All rights reserved. The copying of this manual (without the written permission from the owner) by printing, copying, recording or by any other means, or the full or partial translation of the manual to any other language, including all programming languages, using any electrical, mechanical, magnetic, optical, manual or other methods or devices is forbidden.

Satel reserves the right to change the technical specifications or functions of its products, or to discontinue the manufacture of any of its products or to discontinue the support of any of its products, without any written announcement and urges its customers to ensure, that the information at their disposal is valid.

Satel software and programs are delivered "as is". The manufacturer does not grant any kind of warranty including guarantees on suitability and applicability to a certain application. Under no circumstances is the manufacturer or the developer of a program responsible for any possible damages caused by the use of a program. The names of the programs as well as all copyrights relating to the programs are the sole property of Satel. Any transfer, licensing to a third party, leasing, renting, transportation, copying, editing, translating, modifying into another programming language or reverse engineering for any intent is forbidden without the written consent of Satel.

SATEL PRODUCTS HAVE NOT BEEN DESIGNED, INTENDED NOR INSPECTED TO BE USED IN ANY LIFE SUPPORT RELATED DEVICE OR SYSTEM RELATED FUNCTION NOR AS A PART OF ANY OTHER CRITICAL SYSTEM AND ARE GRANTED NO FUNCTIONAL WARRANTY IF THEY ARE USED IN ANY OF THE APPLICATIONS MENTIONED.

Salo, FINLAND 2016

2 RESTRICTIONS ON USE

SLR6 radio modem has been designed to operate on 403...473 MHz, 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.

SLR6 (403…473 MHz) is allowed to be use 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*: AU, AT, BE, BG, HR, CA, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IS, IE, IT, KR, LT, LU, MT, NL, NO, PL, PT, RO, RU, SG, SI, SK, ES, SE, CH, AE, GB and US.

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

WARNING! Users of SLR6 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.

WARNING! Users of SLR6 radio modems in Canada should be aware, that operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. (RSS Gen section 7.1.5)

WARNING - RF Exposure

To comply with FCC and IC RF exposure compliance requirements, maximum antenna gain is 14 dBi and separation distance of at least 1 meter must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Modification warning statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Class B digital device statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3 PRODUCT CONFORMITY

Hereby, Satel Oy declares that SLR6 radio modems are in compliance with the essential requirements (radio performance, electromagnetic compatibility and electrical safety) 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.

CE0598!

DECLARATION of CONFORMITY

In Accordance with
1999/5/EC Directive

of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity

Doc No: SATEL-DC-RTTE-119
Manufacturer: SATEL Oy
Address: POB 142, (Meriniitynkatu 17), 24101 Salo, Finland

Products :	Type	Model
	SATEL-TA23	**SLR6**

We, the manufacturer of the above-mentioned products, hereby declare that these products conform to the essential requirements of the European Union directive 1999/5/EC and 2011/65/EU. This Declaration of Conformity is based on the following documents:

Type of Product	Test Specification	Doc. No.	Laboratory / Date of Issue
SLR6	EN 300 113-1 V1.7.1 EN 300 113-2 V1.5.1	280186-1 240161R	SGS Fimko / 10.6.2015 NEMKO / 26.6.2013
SLR6	EN 301 489-1 v1.9.2 EN 301 489-5 V1.3.1	281880-1	SGS Fimko / 24.11.2015
SLR6	EN 60950-1:2006 (Second Edition) + A11:2009 + A1:2012 + A12:2011 + A2:2013 Council Recommendation 1999/519/EC	281880-3	SGS Fimko / 17.12.2015

Salo 10.2.2016

SATEL OY

Markus Kantola
CEO

SATEL Oy
P.O.Box 142, FI-24101 SALO, FINLAND
Street: Meriniitynkatu 17, FI-24100 SALO, FINLAND
Tel. +358 2 777 7800, Fax +358 2 777 7810
E-mail: info@satel.com, www.satel.com

SATEL®
WIRELESS WORLD – LOCAL SOLUTION

4 WARRANTY AND SAFETY INSTRUCTIONS

Read these safety instructions carefully before using the product:

- Warranty will be void, if the product is used in any way that is in contradiction with the instructions given in this manual, or if the radio modem housing has been opened or tampered with.

- The radio modem is only to be operated at frequencies allocated by local authorities, and without exceeding the given maximum allowed output power ratings. Satel and its distributors are not responsible, if any products manufactured by it are used in unlawful ways.

- The devices mentioned in this manual are to be used only according to the instructions described in this manual. Faultless and safe operation of the devices can be guaranteed only if the transport, storage, operation and handling of the devices is appropriate. This also applies to the maintenance of the products.

5 INTRODUCTION

Satel Oy is a Finnish electronics and Telecommunications Company specialising in the design and manufacture of wireless data communication products. Satel designs, manufactures and sells radio modems intended for use in applications ranging from data transfer to alarm relay systems. End users of Satel products include both public organisations and private individuals.

Satel is the leading European manufacturer of radio modems. Satel radio modems have been certified in most European countries and also in many non-European countries.

SLR6 is a variant of the standard SATELLINE-M3-TR4 (YM7410) radio modem.

5.1 Description of the product

SLR6 is a UHF radio transceiver modem. It provides a transparent data link with other SLR or SATELLINE-3AS and -EASy family modems.

Figure 1.1 SLR6 radio data modem

SLR6 consists of a radio modem module (SATELLINE-M3-TR4) and a radio interface adapter board, both enclosed into a metal housing. It acts as a plug-in unit for Leica Geosystems GPS devices.

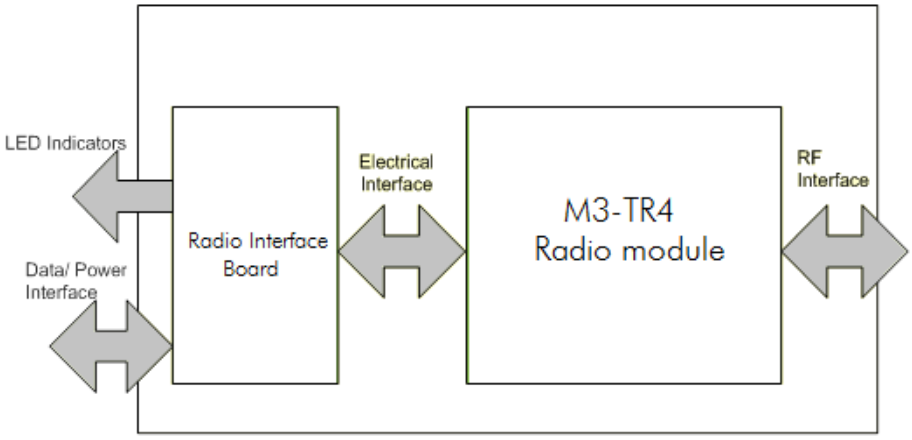


Figure 1.2 Block diagram of SLR6 radio data modem

6 TECHNICAL SPECIFICATIONS

6.1 SLR6 technical specifications

SLR6 complies with the following international standards:

- EN 300 113-1 V.1.7.1 and EN 300 113-2 V1.5.1
- EN 301 489-1 V1.9.2 and EN 301 489-5 V1.3.1 (EMC-requirements)
- EN 60950-1:2006 (Safety Standard)
- ISO 9022-36-05-2 (vibration)
- FCC CFR47 part 90

	RECEIVER	TRANSMITTER	Note!
Frequency range	403...473 MHz		
Tuning range	70 MHz		
Minimum RF frequency step	6.25 kHz		
Channel bandwidth	12.5 kHz / 25 kHz		Programmable
Frequency stability	<1 kHz		
Maximum receiver input power without damage	+14 dBm		
Maximum receiver input power without transmission errors	-10 dBm		FEC ON
Sensitivity	-112 dBm @ 25 kHz -116 dBm@ 12.5 kHz		FEC ON
Blocking	> 86 dB @ 25 kHz > 88 dB @ 12.5 kHz		FEC ON
Intermodulation attenuation	> 61 dB @ 25 kHz > 61 @ 12.5 kHz		FEC ON
CO-channel rejection	> -11 dB @ 25 kHz > -10 dB @ 12.5 kHz		FEC ON
Adjacent channel selectivity	> 56 dB @ 25 kHz > 51 dB @ 12.5 kHz		FEC ON
Spurious rejection	> 67 dB		FEC ON
Typical power consumption @ 6V	1.0W		RX-mode
		4.2 W @ 1 W RF out	TX-mode, Continuous, 50Ω
		3.8 W @ 0.5 W RF out	
		3.1 W @ 0.2 W RF out	
		2.8 W @ 0.1 W RF out	
Transmitter power (programmable)		0.1, 0.2, 0.5, 1 W	TX-mode, 50Ω load
Communication mode	Half-Duplex		
Adjacent channel power		acc. to EN 300 113-1v.1.7.1	TX-mode
Transient adjacent channel power		acc. to EN 300 113-1v.1.7.1	TX-mode
Carrier power stability		< ±1.5 dB	

	DATA MODULE	
Timing	RS-232	
Electrical interface	CMOS 3.3V Inputs and Outputs, LVTTL. (RTS, CTS, RX, TX, +VCC, GND)	
Interface connector	D-connector, 15 pole with coaxial inserts (female)	
Data speed of serial interface	1200 – 115200 bps	
Data speed of radio air interface	4FSK FEC OFF: 19200 bps (25 kHz) 9600 bps (12.5 kHz) 4FSK FEC ON: 14400 bps (25 kHz) 7200 bps (12.5 kHz) 8FSK FEC OFF: 28800 bps (25 kHz) 14400 bps (12.5 kHz) 8FSK FEC ON: 19200 bps (25 kHz) 9600 bps (12.5 kHz) 16FSK FEC ON: 28800 bps (25 kHz) 14400 bps (12.5 kHz)	
Data format	Asynchronous data	
Modulation	4FSK, 8FSK, 16FSK, GMSK	

	GENERAL	
Operating voltage	+6.0 Vdc +/- 5% Vdc	
Temperature range See Note 1.	Type approval condition: -20 °C...+55 °C	
	-30 °C ... +70 °C	Functional
	-25 °C ... +55 °C	Complies with standards
	-40 °C ... +85 °C	Storage
Antenna connector	50 ohm, D-sub Combo-RF, Male	
Housing	Metal housing	
Size L x W x T	96 mm x 56 mm x 9 mm	
Weight	150 g	

Note 1. Automatic Switch OFF when internal temperature during transmission exceeds +96 °C.

	OTHER MEASURES	
ESD-failure threshold	8 kV contact, 15 kV air discharge	
Antenna ESD	±10 kV	Antenna connector. Acc. to EN61000-4-2; 150pF/330Ω
Immunity test	10V/m	

7 USER INTERFACE

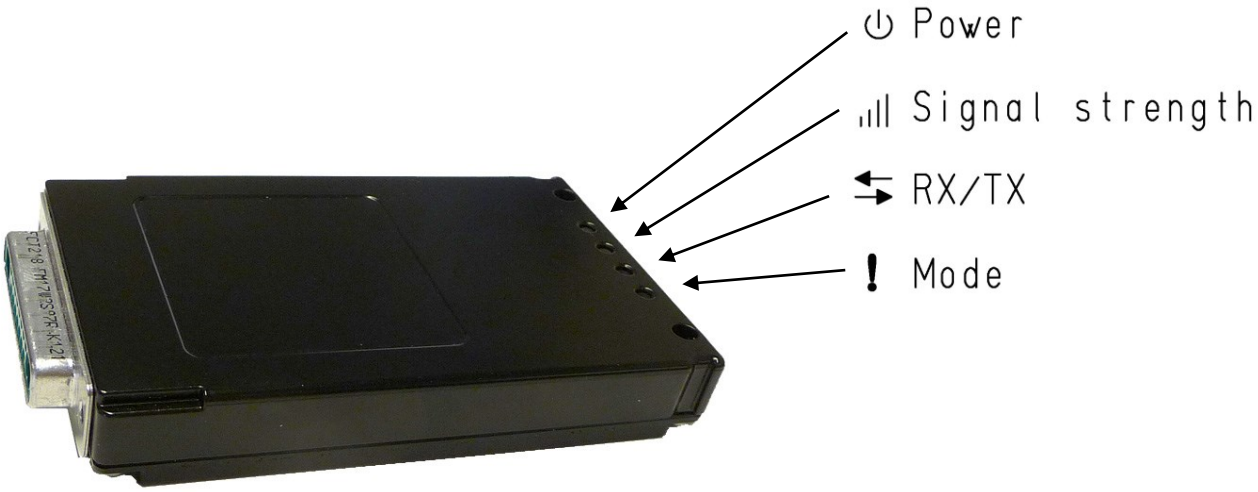
7.1 LED-indicators

There are four (4) LED indicators on the front panel of the radio modem, and they give an indication of the status of the serial port and the radio interface:

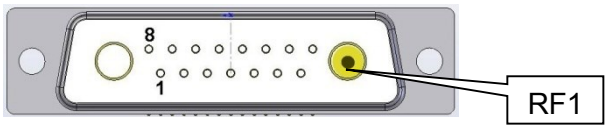
LED	Indication	OFF	Red	Red, Flashing	Green	Green, flashing
Power	ON/OFF	Inactive			Active	
Signal strength	RSSI	No data	Data detected and ok	Data detected, but weak signal		
RX/TX	Data indicator	No data transferred				Data transfer
Mode	Communication or programming	Data Mode	Programming mode			

Description of the LED-indicators:

- *Power* indicates the status of Power ON/OFF
- *Signal strength* indicates the strength of the received signal
- *RX/TX* indicates that the radio modem is receiving or transmitting data via serial port.
- *Mode* indicates whether the modem on Data- or Programming mode.



7.2 D15 connector



D-15 female connector in the radio modem

Direction IN is data from DTE (Data Terminal Equipment) to the radio modem.
Direction OUT is data from the radio modem to the DTE.

Pin No	Signal	Type and Direction	Description	SLR6 support
1	NC	-	Not Connected	-
2	TD	TTL input	Transmit Data (DTE)	x
3	RD	TTL output	Receive Data (DTE)	x
4	GPO/DCD	TTL output	General purpose output / Carrier Detect output	
5	RTS	TTL input	Request to Send by DTE	x
6	CTS	TTL output	Clear to Send by modem	x
7	CPI/CFG	TTL input	General Purpose Input / Config mode	x
8	PWR	6.0 V input	+6 Vdc, +/-5% DC Voltage Supply	max. 1.5 A^@ 2 W
9	GPIO	TTL input/output	General Purpose IO	
10	GND	GND	Signal and Chassis Ground.	x
11	NC	-	Not Connected	-
12	NC	-	Not Connected	-
13	GND	GND	Signal and Chassis Ground	x
14	ID	TTL input/output	1-Wire ID line	x
15	GPIO	TTL input/output	General Purpose IO	
A1	NC	-	Not Connected	-
A2	RF1	Antenna port	UHF Antenna 403-473 MHz	*)

NOTE! Unused pins can be left unconnected.
*) FDS062S, female

Description of pins:

1. NC
Not connected.

2. TD, Transmit data.
CMOS 3.3V. Signal from DTE to modem. Asynchronous serial data.

3. RD, Receive data.
CMOS 3.3V. Signal from modem to DTE. Asynchronous serial data.

4. DCD. Data Carrier Detect.
Not supported

5. RTS, Request to send.
CMOS 3.3V. Signal from DTE to modem.

6. CTS. Clear to send.
CMOS 3.3V. Signal from modem to DTE.

7. GPI/CFG.
CMOS 3.3V. General Purpose I/O / Configuration Mode.

8. PWR
+VDC. Main voltage input. The radio modem is designed for +6 VDC +/- 5%.

9. GPIO. General Purpose I/O.
Not defined.

10. GND. Ground.
Main voltage minus. Signal and chassis ground.

11. and 12. NC.
Not connected.

13. GND. Ground.
Voltage minus. Signal and chassis ground.

14. ID. 1-wire ID-line.

15. GPIO. General Purpose I/O.
Not defined.

A1. Not in use
A2. RF1. Antenna port.
Antenna connector for UHF 403 ... 473 MHz. Input/ Output for UHF-signal.

7.3 RF INTERFACE

The SLR6 modem has a single antenna connector with impedance of 50 ohm.

The output power of the transmitter is adjustable between 0.1, 0.2, 0.5 and 1.0 W. The greatest allowable power depends on limits set by local authorities, which should not be exceeded under any circumstances. The output power of the transmitter should be set to the smallest possible level, which still ensures error free connections under variable conditions. Large output power levels using short connection distances can, in the worst case, cause disturbances to the overall operation of the system.

NOTE!
Setting the radio data modem output power level to that which exceeds the regulations set forth by local authorities is strictly forbidden. The setting and/or using of non-approved power levels may lead to prosecution. Satel and its distributors are not responsible for any illegal use of its radio equipment, and are not responsible in any way of any claims or penalties arising from the operation of its radio equipment in ways contradictory to local regulations and/or requirements and/or laws.

8 Modem settings

8.1 Default settings

The radio modem is delivered with the following default settings (unless otherwise specifically ordered):

DEFAULT VALUES OF THE ADJUSTABLE SETTINGS (the user can change these settings later on)		
Setting	Default value	Range
Radio frequency		
Operating TX frequency	438.000 MHz	403 … 473 MHz
Operating RX frequency	438.000 MHz	403 … 473 MHz
Reference frequency	438.000 MHz	403 … 473 MHz
Channel spacing	25 kHz	12.5 kHz or 25 kHz
Radio settings		
TX power	1 W	0.1, 0.2, 0.5 or 1 W
Signal threshold	-115 dBm	-80 … -118 dBm
FCS	OFF	ON / OFF
TX-start delay	0 ms	0 … 65535 ms
Radio compatibility	SATEL 8FSK-2	SATELLINE 3AS PacCrest-4FSK PacCrest-GMSK TrimTalk450s(P) TrimTalk450s(T) PacCrest-FST SATELLINE 2ASx SATELLINE 3AS-1 SOUTH SATEL 8FSK-1 SATEL 8FSK-2 SATEL 16FSK-1
Addressing		
RX address	OFF	ON / OFF
TX address	OFF	ON / OFF
Serial port		
Data speed	115200 bps	1200 … 115200 bps
Data bits	8	8
Parity bits	None	None, Even, Odd
Stop bits	1	1

Handshaking		Handshaking lines apply to the DATA-port
CTS	TX buffer state	Clear to send, TX buffer state
CD	*not supported*	RSSI- threshold, Data on channel, Always ON
RTS	Ignored	Ignored, Flow Control, Reception Control
Pause length	3 bytes	3 … 255
Additional setup		
Error correction, FEC	OFF	ON / OFF
Error check	OFF	OFF, CRC8Partial, CRC8Full, CRC16Full
Repeater mode	OFF	ON / OFF
SL-commands	ON	ON / OFF
TX delay	0	0 ... 65535 ms
Use channel list	OFF	ON / OFF
Power save mode	OFF	ON / OFF
Add RSSI to data	OFF	ON / OFF

8.2 Configuration

The configuration of SLR6 radio modem can be modified by connecting the modem to the PC and using SATEL Configuration Manager (CM). Programming is done using the serial port of the modem. The serial port settings must match between SLR6 and Configuration manager.

When the SLR6 is set to Service / Programming Mode, the modem uses fixed settings 38400 bps, N, 8, 1 (data speed 38400 bps, no parity, 8 data bits and 1 stop bit).