# GFU30

# Radio Modem Transceiver

# User Guide

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# 1  IMPORTANT NOTICE

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Salo, FINLAND 2016

# 2 RESTRICTIONS ON USE

GFU30 radio modem has 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.

GFU30 (403…473 MHz) 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*:    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

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**WARNING!** Users of GFU30 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 GFU30 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)

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**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 GFU30 radio modem is 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.

$$C \in 0598 \, \textcircled{!}$$

## 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-118

Manufacturer:   SATEL Oy

Address:         POB 142, (Meriniitynkatu 17), 24101 Salo, Finland

| Products : | Type | Model |
|---|---|---|
| | **SATEL-TA23** | **GFU30** |

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 |
|---|---|---|---|
| GFU30 | EN 300 113-1 V1.7.1<br>EN 300 113-2 V1.5.1 | 280186-1<br>240161R | SGS Fimko / 10.6.2015<br>NEMKO / 26.6.2013 |
| GFU30 | EN 301 489-1 v1.9.2<br>EN 301 489-5 V1.3.1 | 281883-1 | SGS Fimko / 24.11.2015 |
| GFU30 | EN 60950-1:2006<br>(Second Edition) +<br>A11:2009 + A1:2012<br>+ A12:2011 +<br>A2:2013<br>Council<br>Recommendation<br>1999/519/EC | 281883-3 | SGS Fimko / 17.12.2015 |

Salo 10.2.2016                                  SATEL OY

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# 4  WARRANTY AND SAFETY INSTRUCTIONS

Read these safety instructions carefully before using the product:

o 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.

o 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.

o 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 markets 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.

GFU30 is a variant of the standard SATELLINE-M3-TR4 (YM7410) radio modem.

## 5.1  Description of the product

GFU30 is a UHF radio transceiver modem. It provides a transparent data link with other GFU or SATELLINE-3AS and -EASy family modems.



Figure 1.1 GFU30 radio data modem

GFU30 consists of a radio modem module (SATELLINE-M3-TR4) and a radio interface adapter board, both enclosed into a plastics housing. It acts as a plug-in unit for Leica Geosystems GPS devices.
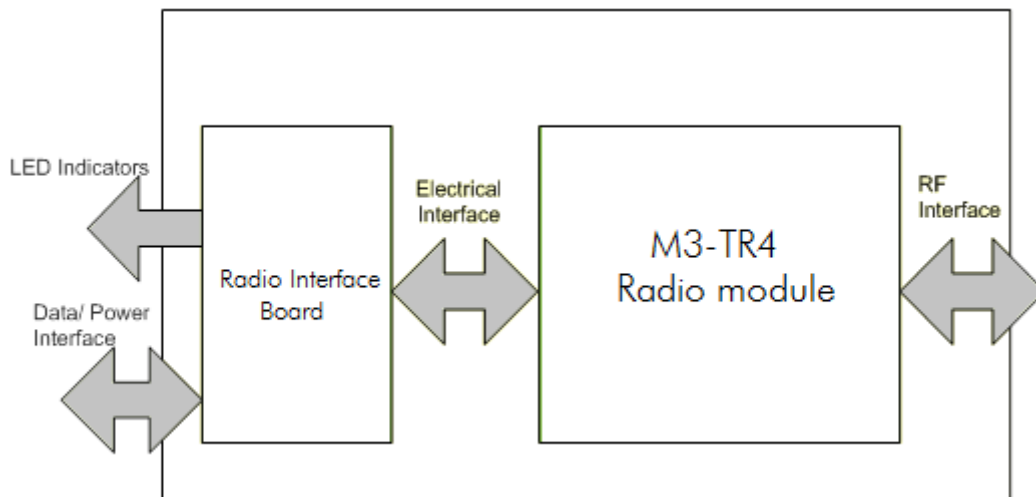


Figure 1.2 Block diagram of GFU30 radio data modem

# 6 Technical specifications

GFU30 complies with the following international standards:

- o EN 300 113-1 V1.7.1 and EN 300 113-2 V.1.5.1
- o EN 301 489-1 V1.9.2 and EN 301 489-5 V1.3.1 (EMC-requirements)
- o EN 60950-1:2006 (safety standard)
- o ISO 9022-36-05-2 (vibration)
- o CFR47 part90

| | 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<br>-116 dBm@ 12.5 kHz | | FEC ON |
| Blocking | > 86 dB @ 25 kHz<br>> 88 dB @ 12.5 kHz | | FEC ON |
| Intermodulation attenuation | > 61 dB @ 25 kHz<br>> 61 @ 12.5 kHz | | FEC ON |
| CO-channel rejection | > -11 dB @ 25 kHz<br>> -10 dB @ 12.5 kHz | | FEC ON |
| Adjacent channel selectivity | > 56 dB @ 25 kHz<br>> 51 dB @ 12.5 kHz | | FEC ON |
| Spurious rejection | > 67 dB | | FEC ON |
| Typical power consumption @ 12 V | 1.1 W | | RX-mode |
| | | 4.4 W @ 1 W RF out | TX-mode,<br>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 | UART | |
| Electrical interface | RS-232 | |
| Interface connector | Lemo | |
| Data speed of serial interface | 1200 – 115200 bps | |
| Data speed of radio air interface | 4FSK FEC OFF:<br>19200 bps (25 kHz)<br>9600 bps (12.5 kHz)<br>4FSK FEC ON:<br>14400 bps (25 kHz)<br>7200 bps (12.5 kHz)<br>8FSK FEC OFF:<br>28800 bps (25 kHz)<br>14400 bps (12.5 kHz)<br>8FSK FEC ON:<br>19200 bps (25 kHz)<br>9600 bps (12.5 kHz)<br>16FSK FEC ON:<br>28800 bps (25 kHz)<br>14400 bps (12.5 kHz) | |
| Data format | Asynchronous data | |
| Modulation | 4FSK, 8FSK, 16FSK, GMSK | |

| | GENERAL | |
|---|---|---|
| Operating voltage | +6.0 Vdc … +30 Vdc +/- 5% Vdc | |
| Temperature range<br>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, TNC female | |
| Housing | Plastic housing | |
| Size L x W x T | 145 mm x 70 mm x  50 mm | |
| Weight | 240 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 | $\pm$10 kV | Antenna connector. Acc. to EN61000-4-2; 150pF/330Ω |
| Immunity test | 10V/m | |

# 7  USER INTERFACE

## 7.1  <u>Data/Power interface</u>
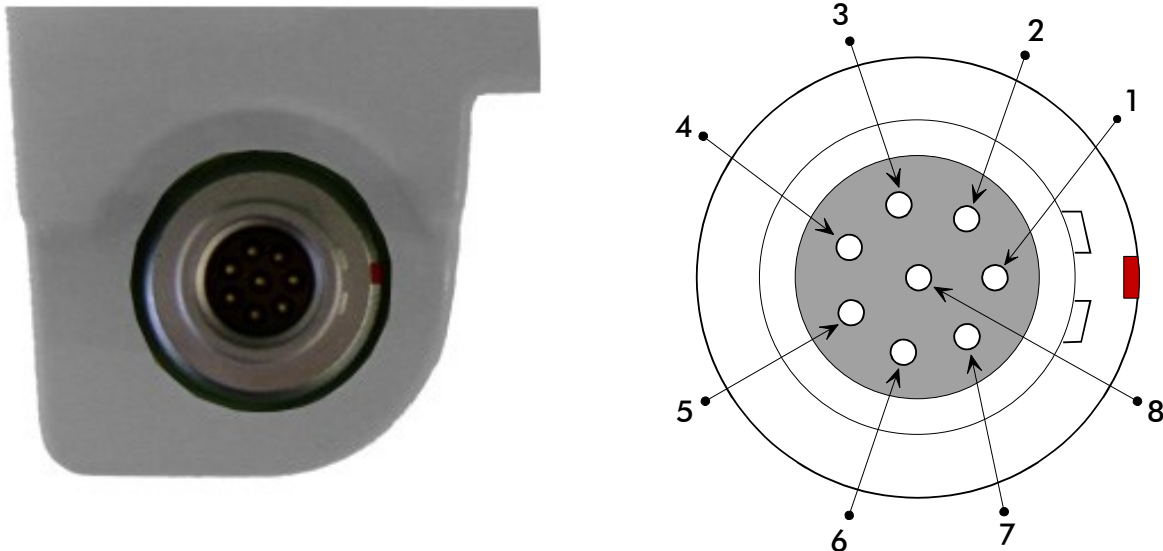


Figure 2.1 Lemo connector and its pin configuration

| PIN | SIGNAL NAME | DIRECTION | DESCRIPTION |
|-----|-------------|-----------|-------------|
| 1 | RTS | IN | HW handshake |
| 2 | CTS | OUT | HW handshake |
| 3 | GND | - | Power and Signal ground |
| 4 | RXD | OUT | Receive data (V24 level) |
| 5 | TXD | IN | Transmit data (V24 level) |
| 6 | ID | IN/OUT | One wire bus terminal to Dallas DS2433 |
| 7 | MODE | IN | Switch:<br>Data mode (0 V)<> Prog. mode (+12 V) |
| 8 | +V | IN | **Supply voltage, +6…+30 Vdc (+/- 5%) |

** Power input must be used with 2A fuse for protection.

## 7.2  LED indicators

| SYMBOL | LED NAME | COLOR | DESCRIPTION |
|--------|----------|-------|-------------|
| ! | Mode | Red | Active if modem switched to Programming mode |
| ⇄ | Rx/Tx | Green | Active if modem receives or transmits data over the serial interface (min. light on 200 ms) |
| ▁▃▅▇ | Link | Red | Active whenever an identifiable data message exists on the radio channel. (min. light on 200 ms) |
| ⏻ | Power | Green | Active if Power connected to modem |



Figure 2.2 Led indicators

## 7.3  RF interface

The GFU30 has a single TNC female 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.

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**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.

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# 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<br>PacCrest-4FSK<br>PacCrest-GMSK<br>TrimTalk450s(P)<br>TrimTalk450s(T)<br>PacCrest-FST<br>SATELLINE 2ASx<br>SATELLINE 3AS-1<br>SOUTH<br>SATEL 8FSK-1<br>SATEL 8FSK-2<br>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 bytes |
| | | | |
| 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 GFU30 modems is made by using the SATEL Configuration Manager. Please use GEV171 programming cable to connect the GFU30 modem to the serial interface of the PC.

SATEL Configuration Manager software and user guide are available on the CD for GFU30 radio modem or from www.satel.com

## 8.3 Programming

The settings of GFU30 are fully configurable. The most recommendable set-up is GEV171 programming cable, a power supply and the SATEL Configuration Manager software.

Programming can be done in any data speed as long as terminal speed and GFU30 data speed match.

In Service Mode it is simple to create a connection with a matching data speed. Once the GFU30 is set to Service Mode GFU30 uses fixed settings 38400 bps, N, 8,1 (data transfer speed 38400 bps, no parity, 8 data bits and 1 stop bit).

GFU30 will shift into the Service Mode by setting the Lemo connector pin 7 to +12 V. When using the GEV171 cable this can be accomplished by setting the Prog mode switch to ON position.