



SATEL®

OEM PRODUCTS

2009

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SATELLINE-M3

Radio Transceiver Module

The SATELLINE-M3 is a small and light-weight radio modem designed for integration into the user's terminal equipment. The modem and transceiver are enclosed in a steel or aluminium housing, depending on the frequency range selected. All the applicable radio, EMC and electrical safety requirements are met without any additional casing.

Depending on the specific requirements of the application, the user of the SATELLINE-M3 has available a number of options related to the technical specifications and functions of the radio transceiver module.

The selection of frequency ranges is ample: in addition to the ordinary UHF ranges between 370 and 470 MHz, VHF ranges 138–174 MHz or 218–238 MHz and the European licence-free 869 MHz band are available. The optional frequency ranges as well as the materials and connector types of the module housing are presented in the Selections table below.

The choice of frequency range influences the functionality of the module. A transceiver module operating on



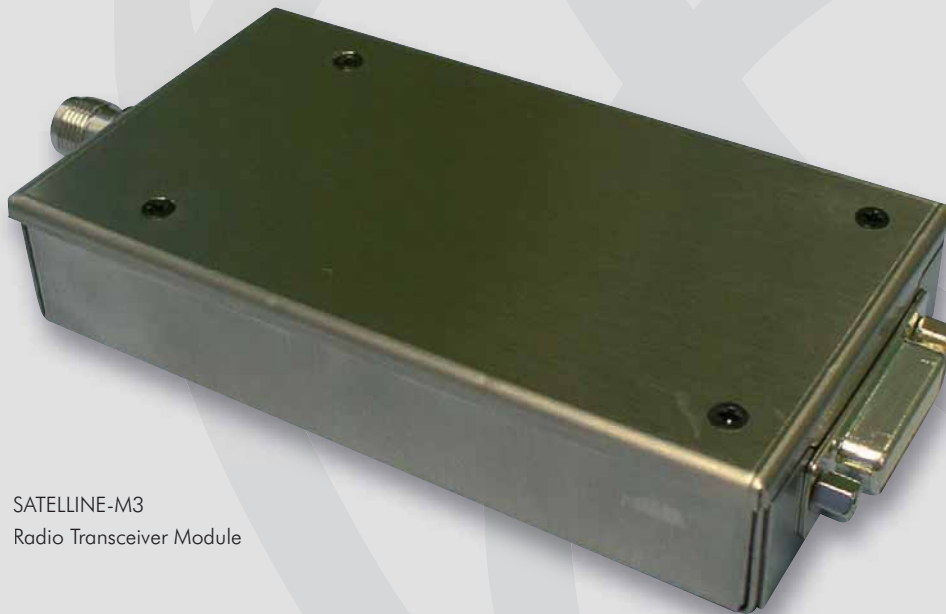
SATELLINE-M3 uses
15 pin female D connector

the 869 MHz band is subject to restrictions on transmitter power and duty cycle. The SATELLINE-M3 operated on the VHF range is a remotely adjustable radio transceiver module controlled through the Master Station by the dedicated SATEL NMS software. In addition to ordinary communication functions, the NMS system offers configuration through radio, efficient diagnostics of the operating status of the radio module, and accumulation of operation statistics data.

In industrial applications, the SATELLINE-M3 is typically mounted inside an instrumentation cabinet equipped with a PLC and power supply, for example.

A SATELLINE-M3 transceiver module is compatible with other modules and SATELLINE-3AS(d) and Epic radio modems operated on the same frequency range.

SATEL Oy keeps developing and extending the list of transceiver module options. For the latest information, please visit our website or contact us or our local representative.



SATELLINE-M3
Radio Transceiver Module

Available options for SATELLINE-M3

| Type and frequency range | UHF, 360-470 MHz *1) | UHF, 869 MHz | VHF, 135-174 MHz / 218-238 MHz *2) |
|---------------------------|----------------------|-----------------|------------------------------------|
| Channel spacing | 12.5 / 20 / 25 kHz | 25 kHz | 12.5 / 25 kHz |
| Antenna connector | TNC / SMA | TNC | TNC |
| Housing / casing material | Stainless Steel | Stainless Steel | Aluminium |

*1) PCC compatible version available, in order to get more information please be in touch with your local SATEL distributor.

*2) TX duty cycle 70 % @ 1 min

Technical specifications for SATELLINE-M3

| Type and frequency range | UHF, 360-470 MHz *1) | UHF, 869 MHz | VHF, 135-174 / 218-238 MHz *2) |
|---|---|---|--|
| Complies with the following international standards | <ul style="list-style-type: none"> • EN 300 113-1 (radio requirements) • EN 301 489-1, -5 (EMC requirements, applicable parts) • EN 60950 (Electrical safety requirements, applicable parts) | <ul style="list-style-type: none"> • EN 300 220-1 (radio requirements) • ETS 300 683 (EMC requirements, applicable parts) | <ul style="list-style-type: none"> • CFR47 part 90 • EN 300 220 at 25 kHz channel spacing • EN 300 113 at 12,5 kHz channel spacing • EMC standard EN 301 489 • Safety standard EN 60950 |
| RADIO TRANSCEIVER | | | |
| Frequency Stability | < ± 1.5 kHz | < ± 2.5 kHz | < ± 1 kHz |
| Type of Emission | F1D | | |
| Communication Mode | Half-Duplex | | |
| RADIO TRANSMITTER | | | |
| Carrier Power | 10 mW...1 W / 50 Ω | 10 mW... 500 mW / 50 Ω | 100 mW, 500 mW, 1 W/50 Ω |
| Carrier Power Stability | + 2 dB / - 3 dB | | |
| RADIO RECEIVER | | | |
| Sensitivity | -115... -110 dBm (BER < 10 E-3) depending on Receiver | -108 dBm (BER < 10 E-3) depending on Receiver settings | -115... -110 dBm (BER < 10 E-3) |
| Common Channel Rejection | > - 12 dB | | > - 12 dB / -8dB |
| Adjacent Channel Selectivity | > 60 dB @ 12.5 kHz, > 70 dB @ 25 kHz | > 60 dB @ 25 kHz | > 60 / 70 dB |
| Intermodulation Attenuation | > 65 dB | > 60 dB | > 60 / 65 dB |
| Spurious Radiations | < 2 nW | | |
| MODEM | | | |
| Interface | RS-232 / RS-485 / RS-422 | | |
| Interface connector | D15, female | | |
| Data Speed of Serial Interface | 300–38 400 bps | | |
| Data Speed of Radio Interface | 19 200 bps (25 kHz channel) 9 600 bps (12.5 kHz channel) | 19 200 bps (25 kHz channel) | 19 200 bps (25 kHz channel) 9 600 bps (12.5 kHz channel) |
| Data format | Asynchronous RS-232 / RS-485 / RS-422 | | |
| GENERAL | | | |
| Operating Voltage | +9.0...+30 VDC | | |
| Power Consumption (average) | 1.7 VA (Receive) 5.5 VA (Transmit) 0.05 VA (in Standby Mode) | 1.7 VA (Receive) 4.0 VA (Transmit) 0.05 VA (in Standby Mode) | 1.5 VA max (Receive) 7.6 VA max (1W Transmit) 0.05 VA typical (when DTR is "0") |
| Temperature ranges | | | |
| Operating | -25 °C ...+55 °C (tests acc. to ETSI standards) -40 °C ...+75 °C (absolute minimum / maximum) | | |
| Storage | -40 °C ...+85 °C | | |

*1) PCC compatible version available, in order to get more information please be in touch with your local SATEL distributor.

*2) TX duty cycle 70 % @ 1 min

SATELLINE-M3EC

Radio Transceiver Module

The SATELLINE-M3EC is a radio module consisting of a data modem and a UHF radio transceiver in a light-weight double PCB structure which conforms to the Eurocard Type B standard. The transceiver module was designed for integration into the user's terminal equipment.

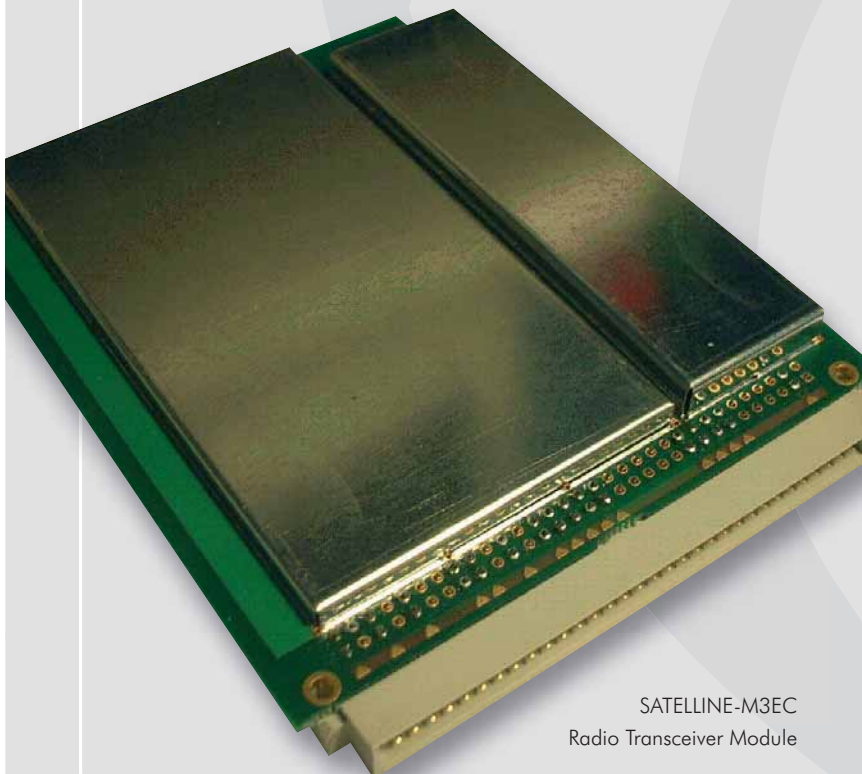
The circuit blocks of the SATELLINE-M3EC are shielded by metal plates. The module is, however, subject to mechanical shocks, and is therefore to be mounted inside an instrumentation cabinet supplied by the user.

Implementation of the SATELLINE-M3EC module is similar to the SATELLINE-M3EC radio modem. The software of the radio module includes a set of auxiliary SL commands providing full control of the module functions in integrated use.

The SATELLINE-M3EC is compatible with the SATELLINE-3AS(d) and Epic radio modems and the SATELLINE-M3 and M3RM radio modules.



32-pin Eurocard connector type B



SATELLINE-M3EC
Radio Transceiver Module

Technical specifications

Complies with the following international standards:

- EN 300 113 (radio requirements)
- EN 301 489-1, -5 (EMC requirements, applicable parts)
- EN 60950 (Electrical safety requirements, applicable parts)

Note: The client is responsible for the final level of EMC and electrical safety characteristics in their product assembly.

RADIO TRANSCEIVER

| | |
|---------------------|--------------------------------|
| Frequency Range | 370–470 MHz |
| Channel Spacing | 12.5 kHz / 25 kHz |
| Number of Channels | 160 / 80 or (2 x 160 / 2 x 80) |
| Frequency Stability | < ± 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 |

RADIO RECEIVER

| | |
|------------------------------|--|
| Sensitivity settings | - 115... -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 |

MODEM

| | |
|--------------------------------|---|
| Interface | RS-232 |
| Interface Connector | 32-pin Eurocard connector type B |
| Data Speed of Serial Interface | 300 – 38 400 bps |
| Data Speed of Radio Interface | 19 200 bps (25 kHz channel) 9 600 bps (12.5 kHz channel) |
| Data format | Asynchronous RS-232 |

GENERAL

| | |
|-----------------------------|--|
| Operating Voltage | +6.3...+14.0 VDC |
| Power Consumption (average) | 1.7 VA (Receive) 5.5 VA (Transmit) 0.05 VA (in Standby Mode) |
| Temperature ranges | |
| Operating | -25 °C...+55 °C (tests acc. to ETSI standards) -40 °C...+75 °C (absolute mini- mum / maximum) |
| Storage | -40 °C...+85 °C |
| Antenna Connector | MMCX, 50 Ω, female |
| Housing | SATELLINE-M3EC is delivered with- out 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 |

SATELLINE-M3RM

Radio Receiver Module

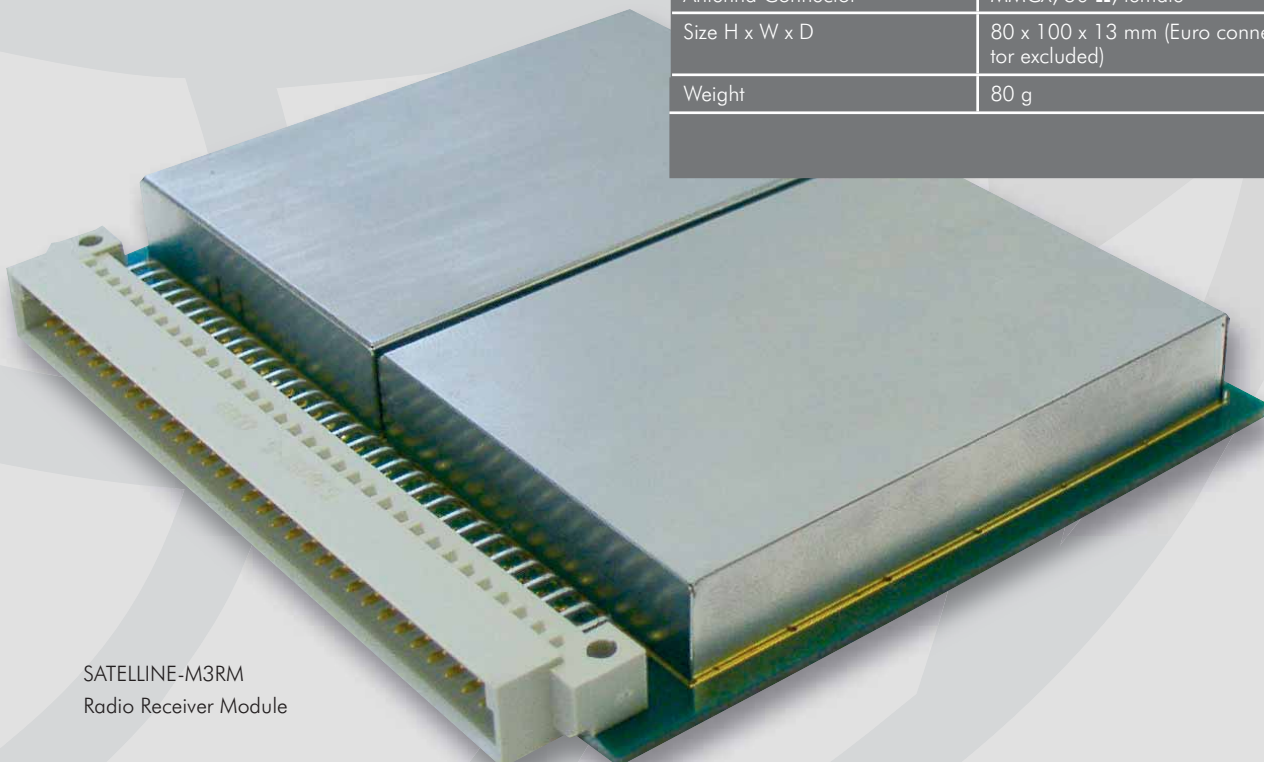
The SATELLINE-M3RM is a radio receiver module consisting of a data modem and an UHF radio receiver in a lightweight single PCB structure that conforms to the Eurocard Type B standard. The receiver module is designed for integration into the user's terminal equipment.

The SATELLINE-M3RM, used for data reception only, is compatible with the SATELLINE-3AS(d) and Epic radio modems and the SATELLINE-M3 radio transceiver module. The circuit blocks of the receiver and the data modem parts of the SATELLINE-M3RM are identical to the SATELLINE-3AS radio modem, except that only the RS-232 serial interface is applicable and the operating voltage range is +5.5... +14 VDC.

In industrial applications, the SATELLINE-M3RM is typically mounted inside an instrumentation cabinet with a PLC and power supply, for example. In this case, no additional casing is required.



32-pin Eurocard connector type B



SATELLINE-M3RM
Radio Receiver Module

Technical specifications

Complies with the following international standards:
 • EN 300 113-1 and EN 300 220-1 (radio requirements),
 • EN 301 489-1 (EMC-requirements), considering that it will be applied inside the terminal unit.

RADIO RECEIVER

| | |
|------------------------------|---|
| Frequency Range | 370–470 MHz |
| Channel Spacing | 12.5 kHz / 20 kHz / 25 kHz |
| Number of Channels | 160 / 80 |
| Frequency Stability | < ± 1.5 kHz |
| Sensitivity | -115... -110 dBm (BER < 10 E-3) |
| Common Channel Rejection | > - 12 dB |
| Adjacent Channel Selectivity | > 60 dB @ 12.5 kHz, > 70 dB @ 25 / 20 kHz |
| Intermodulation Attenuation | > 65 dB |

MODEM

| | |
|--------------------------------|--|
| Interface | RS-232 |
| Interface Connector | Eurocard connector type B, 32 pins |
| Data Speed of Serial Interface | 300 – 38 400 bps |
| Data Speed of Radio Interface | 19 200 bps (25 kHz channel) 9 600 bps (12.5/20 kHz channel) |
| Data format | Asynchronous RS-232 |

GENERAL

| | |
|-----------------------------|--|
| Operating Voltage | + 5.5 ...+ 14 VD |
| Power Consumption (average) | 130 mA (Receive) < 0.01 mA (in Standby Mode) |
| Temperature ranges | |
| Operating | -25 °C...+55 °C (tests acc. to ETSI standards) -40 °C...+75 °C (absolute minimum / maximum) |
| Storage | -40 °C...+85 °C |
| Antenna Connector | MMCX, 50 Ω, female |
| Size H x W x D | 80 x 100 x 13 mm (Euro connector excluded) |
| Weight | 80 g |

SATELLINE-M3TTL1

Radio Transceiver Module

The SATELLINE-M3TTL1 is a small radio transceiver module designed for integration into the customer's equipment, for example RTK systems. The modem and transceiver are packed in a stainless steel enclosure.

The circuit blocks of the SATELLINE-M3TTL1 are identical to those of the SATELLINE-3AS radio modem, except that only the RS-232 serial interface is applicable. The physical interface of the secondary serial port is a low voltage TTL. The location of the D-connector is exceptional: the connector stands out of the lid of the module enclosure. Addition of an enable pin facilitates a master flash update option for integrators of the transceiver module.

The antenna construction and circuitry also differ from the SATELLINE-3AS. The antenna connector of the SATELLINE-M3TTL1 is a female MCX instead of a TNC. The antenna circuitry additionally includes filtration of GSP frequencies, which is particularly useful in RTK systems by avoiding interference with GPS receivers.



The SATELLINE-M3TTL1 is compatible with the SATELLINE-3AS(d) and Epic radio modems, as well as the SATELLINE-M3 radio transceiver module.

SATELLINE-M3TTL2

Radio Transceiver Module



The SATELLINE-M3TTL2 is similar to SATELLINE-M3TTL1 described above, except following differences:

- antenna connector (MMCX)
- location of the D-connector
- size and weight.

Please note also that the SATELLINE-M3TTL2 is packed in an aluminium enclosure.

Technical specifications are the same as SATELLINE-M3 modems UHF 370-470 MHz, with these exceptions:

- International standards
- Interface
- Interface connector
- Data format
- Operating voltage
- Antenna connector
- Housing
- Size
- Weight

Technical specifications

Complies with the following international standards:

- ETS 300 113 and EN 300 220-1 (radio requirements)
- EN 301 489 (EMC-requirements).
- FCC Part 90

RADIO TRANSCEIVER

| | |
|---------------------|--|
| Frequency Range | 370–470 MHz |
| Channel Spacing | 12.5 kHz / 20 kHz / 25 kHz |
| Number of Channels | 160 / 100 / 80 or (2 x 160 / 2 x 100 / 2 x 80) |
| Frequency Stability | < ± 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 |

RADIO RECEIVER

| | |
|------------------------------|--|
| Sensitivity | -115...-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 / 20 kHz |
| Intermodulation Attenuation | > 65 dB |

MODEM

| | |
|--------------------------------|--|
| Interface | RS-232 / LV-TTL |
| Interface Connector | 15 pin male D connector (SATELLINE-M3TTL1) 15 pin female D connector (SATELLINE-M3TTL2) |
| Data Speed of Serial Interface | 300–38 400 bps |
| Data Speed of Radio Interface | 19 200 bps (25 kHz channel) 9 600 bps (12.5 kHz and 20 kHz channel) |
| Data format | Asynchronous RS-232 / LV-TTL |

GENERAL

| | |
|-----------------------------|--|
| Operating Voltage | +6.3...+30 VDC |
| Power Consumption (average) | <1.7 VA (Receive) <5.5 VA (Transmit) 0.05 VA (in Standby Mode) |
| Temperature Range | |
| Operating | -25 °C...+55 °C (tests acc. to ETSI standards) -40 °C...+75 °C (absolute minimum / maximum) |
| Storage | -40 °C...+85 °C |
| Antenna Connector | MCX, 50 Ω, female (SATELLINE-M3TTL1) MMCX, 50 Ω, female (SATELLINE-M3TTL2) |
| Housing | Stainless steel enclosure (SATELLINE-M3TTL1) Aluminium enclosure (SATELLINE-M3TTL2) |
| Size H x W x D | 125 x 64 x 28 mm (SATELLINE-M3TTL1) 125 x 64 x 24 mm (SATELLINE-M3TTL2) |
| Weight | 275 g (SATELLINE-M3TTL1) 160 g (SATELLINE-M3TTL2) |

SATELLINE®-M3-R1

SATELLINE-M3-R1 is a radio receiver module consisting of a data modem and a UHF radio receiver in a lightweight single PCB structure. The receiver module was designed for integration into the user's data communication equipment.

The M3-R1 can be modified to meet the specific requirements of user applications. For example the customer can select type of data bus and antenna connectors. Also the shape of the PCB can be selected in certain limits.

The channel width (12.5, 20 or 25 kHz) and the operating frequency band within the range 403...470 MHz are freely selectable. The M3-R1, used for data reception only, is compatible with the SATELLINE-3AS radio modem. The applicable serial interfaces are RS-232, LVTTTL or TTL.

Thanks to its small size and low power consumption, the M3-R1 is particularly well suited for land surveying applications. It is compatible with the widely used PCC protocol, which facilitates connections with devices in customer application system using this protocol.

- The SATELLINE-M3-T1 and R1 products can be supplied without housing, facilitating installation in the customer's own housing or equipment cabinet.
- Or products can be supplied as pictured in an aluminium housing. The type of antenna connector can be chosen by the customer.



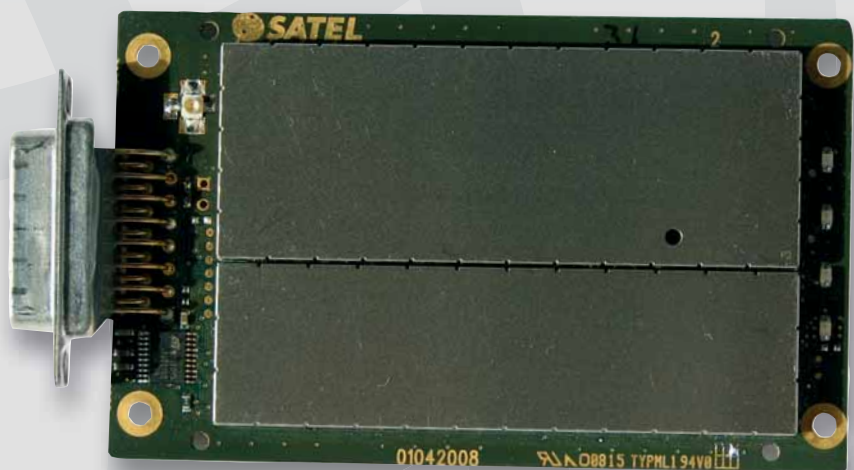
SATELLINE-M3-R1/T1
with aluminium housing

SATELLINE®-M3-T1

SATELLINE-M3-T1 is a radio transmitter module consisting of a data modem and a UHF radio transmitter in a lightweight single PCB structure. The transmitter module was designed for integration into the user's data communication equipment. The transmitter M3-T1 and the receiver M3-R1 can be used as a pair, or independently, where needed.

Like the M3-R1, the M3-T1 also allows free selection of the channel width and operating frequency. Carrier power level can be set between 100 mW and 1 W. The transmitter module is compatible with the SATELLINE-3AS radio modem, and can be included in user systems based on the PCC protocol.

The M3-T1 and M3-R1 modules can be delivered without cover, for flexible installation into the user's equipment. The modules are configured by using the new PC-Tools software, or by means of the SL commands. The small, light-weight and economical M3-R1 and M3-T1 modules provide a viable solution in land surveying and a number of other applications where only receiving or transmitting function is needed.



SATELLINE-M3-R1/T1
without housing

Technical specifications SATELLINE-M3-R1 and SATELLINE-M3-T1

| | SATELLINE-M3-R1 | SATELLINE-M3-T1 | NOTE |
|-------------------------------|---|--|-----------------------------|
| Frequency Range | 403...470 MHz | | |
| Channel Spacing | 12.5 kHz / 20 kHz / 25 kHz | | |
| Tuning Range | 67 MHz | | |
| Spurious Radiations | < 2 nW | | |
| Frequency Error Tolerance | <3 kHz | | |
| Sensitivity | -113...-110 dBm (BER < 10 E-3) | | FEC on |
| Co-channel Rejection | > 10 dB | | FEC on |
| Adjacent Channel Selectivity | > 45 / 50 dB | | FEC on |
| Intermodulation Attenuation | > 55 dB | | FEC on |
| Blocking | 74 dB | | FEC on |
| Spurious Rejection | 60 dB | | -100 dBm on GPS-frequencies |
| Spurious Emission | -57/-47 dBm | | |
| Power Consumption, Typical | 1.2 W | 3 W @ 0.5 W output power 6 W @ 1 W output power | |
| Power Consumption, Sleep ON | 0.24 W | | |
| Type Of Emission | | F1D | |
| Carrier Power | | 100 mW ... 1 W | |
| Adjacent Channel Power | | According to EN 300 113 and CRF47 part 90 | |
| Carrier Stability | | <± 1,5 dB | |
| DATA MODEM | | | |
| Timing | RS-232 | | |
| Electrical Interface | Standard RS-232 or CMOS 3.3 V Inputs and Outputs. (RTS, CTS, RX, TX, +VCC, GND) | | |
| Interface Connector | D-15 or customer specified | | |
| Data Speed Of I/O Interface | 300-38400 bps | | |
| Data Speed Of Radio Interface | 19200 bps (25 kHz channel) 9600 bps (12.5 / 20 kHz channel) | | |
| Data Format | Asynchronous RS-232 | | |
| Modulation | 4FSK | | Optional: GMSK |
| GENERAL | | | |
| Operating Voltage | +7.0...+30 Vdc (+/- 5 %) | | |
| Temperature Range | -25 °C...+55 °C | | |
| Antenna Connector | 50 ohm | | Customer specific |
| Construction | PCB with sheet metal EMI shields | | |
| Size L x W x T | 96 mm x 56 mm x 9 mm | | |
| Weight | 150 g | | |
| OTHER MEASURES | | | |
| ESD-failure Threshold | 8 kV contact, 15 kV air discharge | | |

Comparison table for technical specifications

| | SATELLINE-M3 | SATELLINE-M3EC | SATELLINE-M3RM | SATELLINE-M3TTL1 | SATELLINE-M3TTL2 | SATELLINE-M3-R1 | SATELLINE-M3-T1 |
|---|---------------------------------|---------------------|------------------|------------------|------------------|----------------------------|-----------------|
| FREQUENCY RANGE | | | | | | | |
| UHF 360-470 MHz | • | | | | | | |
| UHF 370-470 MHz | | • | • | • | • | | |
| UHF 403-470 MHz | | | | | | • | • |
| UHF 869 MHz | • | | | | | | |
| VHF 135-174 / 218-238 MHz | • | | | | | | |
| CHANNEL SPACING | | | | | | | |
| 12.5 kHz | •* | • | • | • | • | • | • |
| 20 kHz | •* | • | • | • | • | • | • |
| 25 kHz | •* | • | • | • | • | • | • |
| CARRIER POWER / 50 ohm | 10mW...1W* | 10mW...1W | | 10mW...1W | 10mW...1W | | 100 mW...1 W |
| INTERFACE | | | | | | | |
| RS-232 | • | • | • | • | • | • | • |
| RS-422 / RS-485 | • | | | | | | |
| LV-TTL | | | | • | • | • | • |
| INTERFACE CONNECTOR | | | | | | | |
| D15 female | • | | | | • | D-15 or customer specified | |
| D15 male | | | | • | | | |
| 32-pin Eurocard type B | | • | • | | | | |
| OPERATING VOLTAGE | +9...+30 Vdc | +6.3...+14 Vdc | +5.5...+14 Vdc | +6.3...+30 Vdc | +6.3...+30 Vdc | +7.0...+30 Vdc (+/- 5 %) | |
| SENSITIVITY DBM (BER<10 E-3) | -115...-108 dBm | -115...-110 dBm | -115...-110 dBm | -115...-110 dBm | -115...-110 dBm | -113...-110 dBm | |
| ANTENNA CONNECTOR | | | | | | | |
| TNC | • | | | | | | |
| SMA | • | | | | | | |
| MCX | | | | • | | | |
| MMCX | | • | • | | • | | |
| SIZE H x W x D | Depends on the housing material | 100 x 123.5 x 13 mm | 80 x 100 x 13 mm | 125 x 64 x 28 mm | 125 x 64 x 24 mm | 96 mm x 56 mm x 9 mm | |
| WEIGHT | | 140 g | 80 g | 275 g | 160 g | 150 g | |
| STORE & FORWARD FUNCTION | • | • | | • | • | | |
| COMPATIBILITY WITH SATELLINE-3AS AND EPIC | • | • | • | • | • | • | • |
| COMPLIES WITH STANDARDS | | | | | | | |
| ETS 300 113 | •* | • | • | • | • | | |
| EN 300 220-1 | •* | | • | • | • | | |
| EN 301 489 | •* | • | • | • | • | | |
| FCC Part 90 | | | | • | • | | |
| EN 60950 | •* | • | | | | | |
| ETS 300 683 | •* | | | | | | |
| CRF47 Part 90 | •* | | | | | | |

* Depends on the frequency used

Masters in wireless data communication

SATEL Oy is a Finnish electronics and telecommunications company that specialises in the design, manufacturing and international marketing of radio modems for data communication and alarm transfer. We are a leading supplier in Europe, and are currently extending our business into other market areas.

One of the cornerstones of SATEL's success is the experienced personnel, many of whom have devoted a major part of their working lives to wireless data communications technology. Our product development team, in particular, is known for its innovativeness and efficiency. Consequently, SATEL possesses the world's widest selection of products in its field.

SATEL Products Ensure Reliable Data Transfer

Every SATEL radio modem is designed and manufactured in Finland and those are used in a variety of applications worldwide. SATELLINE radio modems are used at airports for different monitoring and control applications, in industrial plants to set up internal data transfer networks and in cities for monitoring and traffic control. SATELLINE radio modems have been used, for example, to set up citywide alarm transfer networks and location data based traffic monitoring systems to enable smoother running of public transport and accurate timetable information at bus stops.

Because of the diversity of the applications, SATEL has adapted the policy of providing every product with a reasonable number of parallel versions. Our mission is to help our customers solve their local area data communication problems. This is why we are always open to the response and wishes from our customers.

Please feel free to contact your local SATEL distributor or us to discuss of the existing OEM products and your specify need. To locate your nearest SATEL distributor please visit www.satel.com/distributors



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