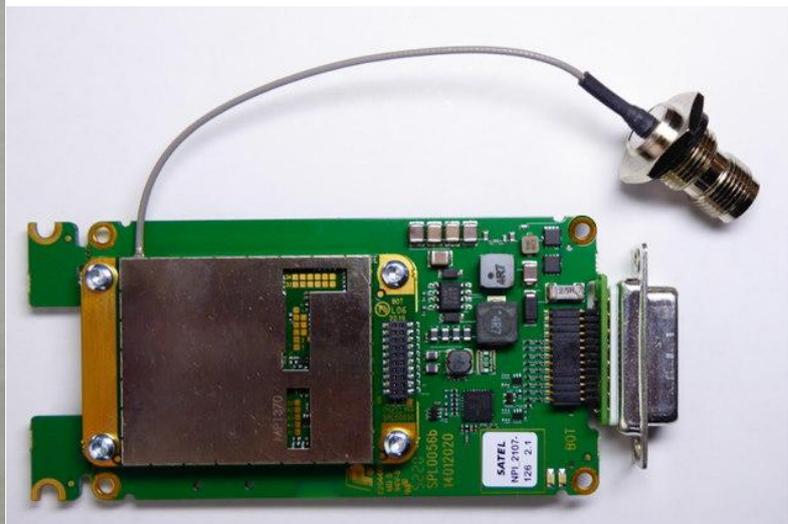


SATEL Radio Module SATEL-B2 Motherboard Assemblies User Guide



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 2025

Copyright: 2025 SATEL Oy

No part of this document may be reproduced, transmitted or stored in a retrieval system in any form or by any means without the prior written permission of SATEL Oy. This document is provided in confidence and must not be distributed to third parties without the express permission of SATEL Oy.

RESTRICTIONS ON USE – SATEL-B2-TR4+

SATEL-B2-TR4+ radio modems have been designed to operate on the 403-473 MHz frequency band, the exact use of which differs from one region and 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 in each specific country.

SATEL-B2 motherboard and SATEL radio modules are available as:

- **Enclosed assemblies inside a metal enclosure** (assigned as SATEL-B2 “ME” assemblies described in this user guide) are FCC/EU certified.
- **Board level OEM variants without enclosures** (assigned as SATEL-B2 “MP” assemblies and described in this user guide):
 - The board level assemblies are intended to be integrated inside host devices, the manufacturer or integrator of which are responsible for taking care of the applicable local approvals and requirements.
 - As the radio module (SATEL-TR4+) itself is FCC/EU certified, the modular approval approach can be used for FCC approvals in USA and Canada. The modular approvals are not applied in EU, but in most cases, only partial supplementary measurements are required.

NOTE on label requirements:

The board level SATEL-B2 MP assemblies (the assemblies without the metal enclosure) are intended to be integrated into a host device or an enclosure. Therefore, the product related FCC ID and IC ID identifier markings must be visible in the host device chassis.

Restrictions on use:

SATEL-B2-TR4+ (the product variants with the metal enclosure described in this user guide) are allowed to be used in the following countries on 403-473 MHz band, either on license free channels or on channels where the operation requires a license. More detailed information is available at the local frequency management authority.

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

NOTE: In Europe the allowed modulations are:

- 4FSK/8FSK/16FSK on 12.5 kHz radio channels
- 4FSK/8FSK on 25 kHz radio channels

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING! Users of **SATEL-B2-TR4+** 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 transceiver on this frequency band without a proper permit is strictly forbidden.



WARNING - RF Exposure!

To comply with CE, FCC and IC RF exposure compliance requirements the maximum antenna gain is 14 dBi and **the minimum separation distance (listed in the table below)** must be maintained between the antenna of SATEL-B2-TR4+ and all persons when transmitting on 403-473 MHz frequency band.

<i>Antenna Gain [dBi]</i>	<i>Separation distance [cm]</i>
0	23
4	36
6	45
8	56
10	71
12	89
14	112

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.

RESTRICTIONS ON USE – SATEL-B2-TR489

SATEL-B2-TR489 radio modems have been designed to operate on the following frequency bands, the exact use of which differs from one region and country to another:

- 403-473 MHz (licenced frequencies in most countries)
- 869.4-869.65 MHz (the pan-European licence-free frequency band as defined by the European Conference of Postal and Telecommunications Administrations CEPT/ERC/REC 70-03 recommendation relating to the use of Short Range Devices (SRD))
- 902-928 MHz (licence-free ISM frequency band in USA and Canada)

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 in each specific country. For example, the use of 869.4-869.65 MHz frequency band is strictly forbidden in North America. Likewise, the use of 902-928 MHz frequency band is forbidden in Europe.

SATEL-B2 motherboard and SATEL radio modules are available as:

- **Enclosed assemblies inside a metal enclosure** (assigned as SATEL-B2 “ME” assemblies described in this user guide) are FCC/EU certified
- **Board level OEM variants without enclosures** (assigned as SATEL-B2 “MP” assemblies).
 - The board level assemblies are intended to be integrated inside host devices, the manufacturer or integrator of which are responsible for taking care of the applicable local approvals and requirements.
 - As the radio module (SATEL-TR489) itself is FCC/EU certified, the modular approval approach can be used for FCC approvals in USA and Canada. The modular approvals are not applied in EU, but in most cases, only partial supplementary measurements are required.

NOTE on label requirements:

The board level SATEL-B2 MP assemblies (the assemblies without the metal enclosure) are intended to be integrated into a host device or an enclosure. Therefore, the product related FCC ID and IC ID identifier markings must be visible in the host device chassis.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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.

Restrictions on use - 403-473 MHz frequency band:

SATEL-B2-TR489 (the product variants with the metal enclosure described in this user guide) are allowed to be used in the following countries on 403-473 MHz band, either on license free channels or on channels where the operation requires a license. More detailed information is available from the local frequency management authority.

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

WARNING! Users of **SATEL-B2-TR4+** 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 transceiver on this frequency band without a proper permit is strictly forbidden.



WARNING - RF Exposure!

To comply with CE, FCC and IC RF exposure compliance requirements the maximum antenna gain is 14 dBi and **the minimum separation distance (listed in the table below)** must be maintained between the antenna of SATEL-B2-TR489 and all persons when transmitting on 403-473 MHz frequency band.

<i>Antenna Gain [dBi]</i>	<i>Separation distance [cm]</i>
0	23
4	36
6	45
8	56
10	71
12	89
14	112

Restrictions on use – 869.4-869.65 MHz frequency band:

SATEL-B2-TR489 (the product variants with the metal enclosure described in this user guide) are allowed to be used in the following countries on 869.4-869.65 MHz band, either on license free channels or on channels where the operation requires a license. More detailed information is available from the local frequency management authority.

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

NOTE: The following restrictions apply to the pan-European licence-free 869.4-869.65 MHz frequency band:

- The maximum allowed transmitted power from the antenna is 500 mW ERP (Effective Radiated Power relative to a half-wave dipole antenna in any certain direction) - in other words, the antenna gain must NOT exceed the signal loss of the antenna cable in case the transmitter power is set to 500 mW
- The maximum allowed duty cycle of the transmission is 10% (internally limited by the radio modem)



WARNING - RF Exposure!

The minimum separation distance of 25 cm must be maintained between the antenna of SATEL-B2-TR489 and all persons when transmitting on 869.4-869.65 MHz frequency band.

Restrictions on use - 902-928 MHz frequency band:

SATEL-B2-TR489 ME1/ME2/M3 assemblies (the assemblies inside the metal enclosure described in this user guide) are allowed to be used on 902-928 MHz band on license free channels in the following countries. More detailed information is available at the local frequency management authority.

Countries: AU, CA, US

The frequency band in USA and Canada is 902 – 928 MHz. In Australia and Brazil the frequency band is limited to 915 – 928 MHz due to the local regulations. SATEL provides the specific product variants that are configured for the specific regions.



WARNING - RF Exposure!

To satisfy FCC and ISED RF exposure requirements for mobile transmitting devices, **a separation distance of 35 cm or more** must be maintained between antenna of this device and persons during device operation when transmitting on 902-928 MHz frequency band.

This device contains the radio transmitter module that has been approved by Federal Communications Commission (FCC ID: MRBSATEL-TA43) and Innovation, Science and Economic Development (ISED) Canada (IC: 2422A-SATELTA43) to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antenna type	Manufacturer	Antenna model	Maximum gain (dBi)
Omnidirectional (whip)	Laird Connectivity	FG9026	6
Directional (yagi)	PulseLarsen Antennas	YA6900W	6

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s) and part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

PRODUCT CONFORMITY

Hereby, SATEL Oy declares that SATEL-B2 ME assemblies, incorporating SATEL-TR4+ or SATEL-TR489 radio module in the metal enclosure described in this user guide, are in compliance with the essential requirements (radio performance, electromagnetic compatibility and electrical safety) and other relevant provisions of Directive 2014/53/EU. Therefore, the equipment is labelled with the CE marking.



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.
- To prevent damage both the radio modem and any terminal devices must always be switched OFF before connecting or disconnecting the serial connection cable. It should be ascertained that different devices used have the same ground potential. Before connecting any power cables, the output voltage of the power supply should be checked.
- Any radio link can be susceptible to external interference and signal degradation by its nature. Because of that, the effects of possible interference mechanisms and the sufficient back-up schemes must be taken into account in the system design of the critical applications.

TABLE OF CONTENTS

IMPORTANT NOTICE	2
RESTRICTIONS ON USE – SATEL-B2-TR4+	3
RESTRICTIONS ON USE – SATEL-B2-TR489	5
PRODUCT CONFORMITY.....	9
WARRANTY AND SAFETY INSTRUCTIONS	10
TABLE OF CONTENTS	11
1. INTRODUCTION	13
1.1 SATEL-B2 motherboard.....	13
1.2 Board level SATEL-B2 “MP” assemblies without enclosure	15
1.3 Enclosed SATEL-B2 “ME” assemblies.....	16
1.4 Radio modules for SATEL-B2 assemblies.....	17
1.5 List of radio module/SATEL-B2 motherboard assemblies.....	18
1.5.1 SATEL-B2 assemblies without radio module.....	18
1.5.2 SATEL-B2 assemblies with SATEL-TR4+ radio module	18
1.5.3 SATEL-B2 motherboard assemblies with SATEL-TR489 radio module	19
1.6 Accessories	21
2 SATEL-B2 TECHNICAL SPECIFICATIONS	22
3 EXTERNAL INTERFACE & CONNECTORS.....	23
3.1 Connector pinouts	25
3.2 Power supply	26
3.3 Serial ports.....	26
3.4 General purpose input/output (GPIO) lines.....	26
3.5 Antenna interface	26
3.6 LED indicators (board level SATEL-B2 assemblies MP1, MP2, M3)	27

4	HOW TO ASSEMBLE RADIO MODULE ON MOTHERBOARD	28
5	INSTALLATION OF SATEL-B2 ASSEMBLIES	30
5.1	Considerations	30
5.2	Wiring.....	31
6	CHECK LIST.....	32
7	DIMENSIONS - SATEL-B2 ME1 ASSEMBLY	33
8	DIMENSIONS - SATEL-B2 ME2 ASSEMBLY	34
9	DIMENSIONS - SATEL-B2 ME3 ASSEMBLY	35
10	DIMENSIONS - SATEL-B2 MP1 ASSEMBLY.....	36
11	DIMENSIONS - SATEL-B2 MP3 ASSEMBLY.....	37

1. 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 manufacturer of radio modems that has field proven solutions based on vast experience in mission critical wireless systems. SATEL radio modems have been certified in most European countries and also in many non-European countries.

SATEL-TR4+ / SATEL-TR49 / SATEL-TR489 / SATEL-TR300 radio modules provide a cost-effective way to integrate radio connectivity in various devices thus adding value and performance of the customer systems. The uniform form factor and connector interface enable integrators to choose between several SATEL radio module variants depending on the feasible frequency band or the required radio compatibility.

SATEL-TR4+ / SATEL-TR49 / SATEL-TR489/SATEL-TR300 radio modules attached on SATEL-B2 motherboard are essentially backwards compatible to the widely used SATELLINE-M3-TR1 radio module – the connectors are identical with the same pinout. Likewise, SATEL-TR489 radio module on SATEL-B2 motherboard is backwards compatible with SATELLINE-M3-TR1 869 radio module.

The characteristics of the radio modules and the instructions for their use are described in the integration guides of the radio modules.

Please visit: www.satel.com

For more detailed information, contact: technical.support@satel.com

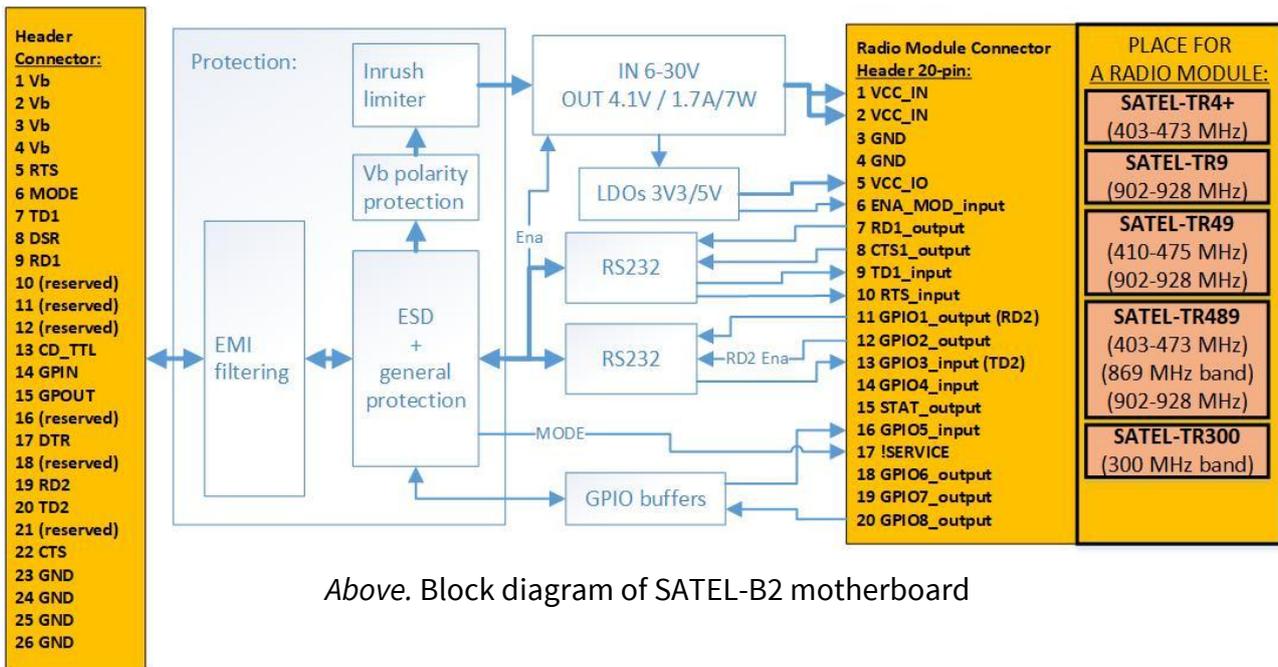
1.1 **SATEL-B2 motherboard**

SATEL-B2 motherboard is designed to house a SATEL radio module. It regulates the supply voltage for the radio module and provides the electrical connections by which the radio module and the user system communicate:

- Operating voltage +7...+27.5 VDC
- RS232 serial data interface (*Port1*)
- One general purpose input (controls GPIO5 input of the radio module)
- One general purpose output (controlled by GPIO8 output of the radio module)
- Secondary RS232 serial interface (Port2) for control purposes (“Diagnostics”, SL commands)

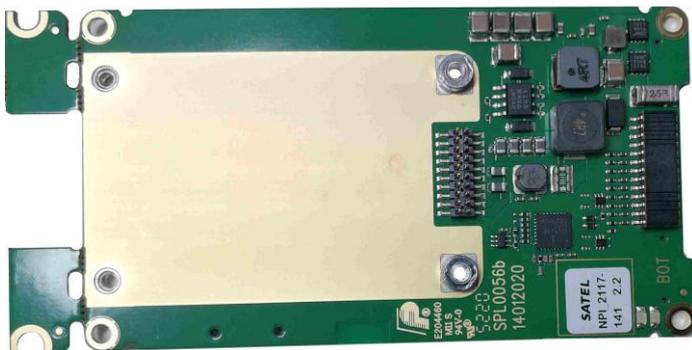
SATEL-B2 motherboard and SATEL radio modules are available as both enclosed assemblies (assigned as SATEL-B2 “ME” assemblies), and as board level OEM variants without enclosures (assigned as SATEL-B2 “MP” assemblies).

The combination of a SATEL radio module on a SATEL-B2 motherboard is easy to integrate into the host device. Due to the modular structure, integrators can always select the optimum radio solution that fits the application.

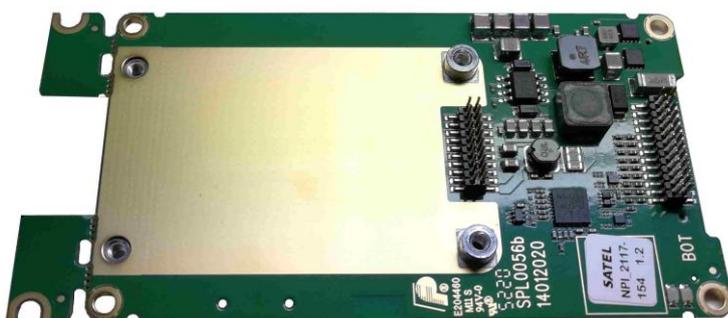


Above. Block diagram of SATEL-B2 motherboard

Below. SATEL-B2 motherboard assembly variants (B2A and B2B)



SATEL-B2 motherboard with the female horizontal 26-pin header connector
(B2A variant)



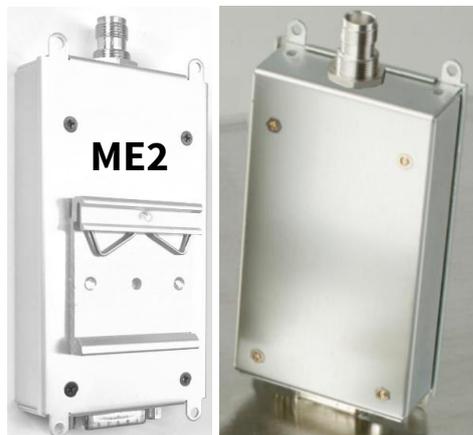
SATEL-B2 motherboard with the male vertical 26-pin header connector
(B2B variant)

1.2 Board level SATEL-B2 "MP" assemblies without enclosure

Assembly	Description
MP1	<ul style="list-style-type: none"> • Radio module: as defined by order code • Motherboard: B2A (horizontal female 26-pin connector, KL0058) • Heat transfer block (ME0909) to be installed between the boards • Heat transfer block (ME0910) for conducting heat to external structures • Mounting screws (4 pcs, NC1030)
MP2	<ul style="list-style-type: none"> • Radio module: as defined by order code • Motherboard: B2A (horizontal female 26-pin connector, KL0058) • Heat transfer block (ME0909) to be installed between the boards • Heat transfer block (ME0910) for conducting heat to external structures • Mounting screws (4 pcs, NC1030) • D15 adapter (KL0024)
MP3	<ul style="list-style-type: none"> • Radio module: as defined by order code • Motherboard: B2B (vertical male 26-pin connector, KL0057) • Heat transfer block (ME0909) to be installed between the boards • Heat transfer block (ME0910) for conducting heat to external structures • Mounting screws (4 pcs, NC1030)

1.3 Enclosed SATEL-B2 "ME" assemblies

Assembly	Description
ME1	<ul style="list-style-type: none"> • Radio module: as defined by order code • Enclosure: aluminium / mounting ears • Antenna connector: TNC female • Motherboard: B2A (horizontal female connector, KL0058) • D15 adapter SPL0064b (KL0024)
ME2	<ul style="list-style-type: none"> • Radio module: as defined by order code • Enclosure: aluminium / mounting ears / DIN clip • Antenna connector: TNC female • Motherboard: B2A (horizontal female connector, KL0058) • D15 adapter SPL0064b (KL0024)
ME3	<ul style="list-style-type: none"> • Radio module: as defined by order code • Enclosure: aluminium / mounting ears / DIN clip • Antenna connector: BNC female • Motherboard: B2A (horizontal female connector, KL0058) • D15 adapter SPL0064b (KL0024)



1.4 Radio modules for SATEL-B2 assemblies

The radio modules listed below are readily available for SATEL-B2 assemblies. Contact SATEL for SATEL-B2 combinations with other radio modules (note also that the radio module must be the product variant with the 20-pin interface connector on the BOTTOM side of the board to fit on SATEL-B2 motherboards).

Radio module	Description (radio frequencies, encryption support,)
YM7470 SATEL-TR4+	Frequency bands: 403-473 MHz Encryption support: YES
YM7475 SATEL-TR4+	Frequency bands: 403-473 MHz Encryption support: NO
YM8810 SATEL-TR489	Frequency bands: 403-473 / 869 / 902-928 MHz Encryption support: YES
YM8815 SATEL-TR489	Frequency bands: 403-473 / 869 / 902-928 MHz Encryption support: NO
YM8820 SATEL-TR489 US/CA	Frequency bands: 403-473 / 902-928 MHz Encryption support: YES
YM8825 SATEL-TR489 US/CA	Frequency bands: 403-473 / 902-928 MHz Encryption support: NO
YM8830 SATEL-TR489 AU/BR	Frequency bands: 403-473 / 915-928 MHz Encryption support: YES
YM8835 SATEL-TR489 AU/BR	Frequency bands: 403-473 / 915-928 MHz Encryption support: NO
YM8850 SATEL-TR489 EU 400 / 869	Frequency bands: 403-473 / 869 MHz Encryption support: YES
YM8855 SATEL-TR489 EU 400 / 869	Frequency bands: 403-473 / 869 MHz Encryption support: NO
YM8860 SATEL-TR489 EU 869	Frequency bands: 869 MHz Encryption support: YES
YM8865 SATEL-TR489 EU 869	Frequency bands: 869 MHz Encryption support: NO

1.5 List of radio module/SATEL-B2 motherboard assemblies

The assemblies listed below are readily available (contact SATEL for other combinations).

1.5.1 SATEL-B2 assemblies without radio module

Radio module	B2 motherboard assembly	Order code of the combination
None	MP1	-> YR0000-MP1
None	MP2	-> YR0000-MP2
None	MP3	-> YR0000-MP3

1.5.2 SATEL-B2 assemblies with SATEL-TR4+ radio module

Radio module	B2 motherboard assembly	Order code of the combination
YM7470 SATEL-TR4+	MP1	-> YR7470-MP1
YM7470 SATEL-TR4+	MP2	-> YR7470-MP2
YM7470 SATEL-TR4+	MP3	-> YR7470-MP3
YM7470 SATEL-TR4+	ME1	-> YR7470-ME1
YM7470 SATEL-TR4+	ME2	-> YR7470-ME2
YM7470 SATEL-TR4+	ME3	-> YR7470-ME3
YM7475 SATEL-TR4+	MP1	-> YR7475-MP1
YM7475 SATEL-TR4+	MP2	-> YR7475-MP2
YM7475 SATEL-TR4+	MP3	-> YR7475-MP3
YM7475 SATEL-TR4+	ME1	-> YR7475-ME1
YM7475 SATEL-TR4+	ME2	-> YR7475-ME2
YM7475 SATEL-TR4+	ME3	-> YR7475-ME3

1.5.3 SATEL-B2 motherboard assemblies with SATEL-TR489 radio module

Radio module	B2 motherboard assembly	Order code of the combination
YM8810 SATEL-TR489	MP1	-> YR8810-MP1
YM8810 SATEL-TR489	MP2	-> YR8810-MP2
YM8810 SATEL-TR489	MP3	-> YR8810-MP3
YM8810 SATEL-TR489	ME1	-> YR8810-ME1
YM8810 SATEL-TR489	ME2	-> YR8810-ME2
YM8810 SATEL-TR489	ME3	-> YR8810-ME3
YM8815 SATEL-TR489	MP1	-> YR8815-MP1
YM8815 SATEL-TR489	MP2	-> YR8815-MP2
YM8815 SATEL-TR489	MP3	-> YR8815-MP3
YM8815 SATEL-TR489	ME1	-> YR8815-ME1
YM8815 SATEL-TR489	ME2	-> YR8815-ME2
YM8815 SATEL-TR489	ME3	-> YR8815-ME3
YM8820 SATEL-TR489 US/CA	MP1	-> YR8820-MP1
YM8820 SATEL-TR489 US/CA	MP2	-> YR8820-MP2
YM8820 SATEL-TR489 US/CA	MP3	-> YR8820-MP3
YM8820 SATEL-TR489 US/CA	ME1	-> YR8820-ME1
YM8820 SATEL-TR489 US/CA	ME2	-> YR8820-ME2
YM8820 SATEL-TR489 US/CA	ME3	-> YR8820-ME3
YM8825 SATEL-TR489 US/CA	MP1	-> YR8825-MP1
YM8825 SATEL-TR489 US/CA	MP2	-> YR8825-MP2
YM8825 SATEL-TR489 US/CA	MP3	-> YR8825-MP3
YM8825 SATEL-TR489 US/CA	ME1	-> YR8825-ME1
YM8825 SATEL-TR489 US/CA	ME2	-> YR8825-ME2
YM8825 SATEL-TR489 US/CA	ME3	-> YR8825-ME3
YM8830 SATEL-TR489 AU/BR	MP1	-> YR8830-MP1
YM8830 SATEL-TR489 AU/BR	MP2	-> YR8830-MP2
YM8830 SATEL-TR489 AU/BR	MP3	-> YR8830-MP3
YM8830 SATEL-TR489 AU/BR	ME1	-> YR8830-ME1
YM8830 SATEL-TR489 AU/BR	ME2	-> YR8830-ME2
YM8830 SATEL-TR489 AU/BR	ME3	-> YR8830-ME3

Radio module	B2 motherboard assembly	Order code of the combination
YM8835 SATEL-TR489 AU/BR	MP1	-> YR8835-MP1
YM8835 SATEL-TR489 AU/BR	MP2	-> YR8835-MP2
YM8835 SATEL-TR489 AU/BR	MP3	-> YR8835-MP3
YM8835 SATEL-TR489 AU/BR	ME1	-> YR8835-ME1
YM8835 SATEL-TR489 AU/BR	ME2	-> YR8835-ME2
YM8835 SATEL-TR489 AU/BR	ME3	-> YR8835-ME3
YM8850 SATEL-TR489 EU 400 / 869	MP1	-> YR8850-MP1
YM8850 SATEL-TR489 EU 400 / 869	MP2	-> YR8850-MP2
YM8850 SATEL-TR489 EU 400 / 869	MP3	-> YR8850-MP3
YM8850 SATEL-TR489 EU 400 / 869	ME1	-> YR8850-ME1
YM8850 SATEL-TR489 EU 400 / 869	ME2	-> YR8850-ME2
YM8850 SATEL-TR489 EU 400 / 869	ME3	-> YR8850-ME3
YM8855 SATEL-TR489 EU 400 / 869	MP1	-> YR8855-MP1
YM8855 SATEL-TR489 EU 400 / 869	MP2	-> YR8855-MP2
YM8855 SATEL-TR489 EU 400 / 869	MP3	-> YR8855-MP3
YM8855 SATEL-TR489 EU 400 / 869	ME1	-> YR8855-ME1
YM8855 SATEL-TR489 EU 400 / 869	ME2	-> YR8855-ME2
YM8855 SATEL-TR489 EU 400 / 869	ME3	-> YR8855-ME3
YM8860 SATEL-TR489 EU 869	MP1	-> YR8860-MP1
YM8860 SATEL-TR489 EU 869	MP2	-> YR8860-MP2
YM8860 SATEL-TR489 EU 869	MP3	-> YR8860-MP3
YM8860 SATEL-TR489 EU 869	ME1	-> YR8860-ME1
YM8860 SATEL-TR489 EU 869	ME2	-> YR8860-ME2
YM8860 SATEL-TR489 EU 869	ME3	-> YR8860-ME3
YM8865 SATEL-TR489 EU 869	MP1	-> YR8865-MP1
YM8865 SATEL-TR489 EU 869	MP2	-> YR8865-MP2
YM8865 SATEL-TR489 EU 869	MP3	-> YR8865-MP3
YM8865 SATEL-TR489 EU 869	ME1	-> YR8865-ME1
YM8865 SATEL-TR489 EU 869	ME2	-> YR8865-ME2
YM8865 SATEL-TR489 EU 869	ME3	-> YR8865-ME3

1.6 Accessories

Accessories are ordered separately. SATEL provides a wide selection of accessories and solutions for SATEL radio modems.

- Antennas
- Serial data/Power cables and adapters
- RF-cables
- Mounting parts
- Filters and lightning protectors
- Power supplies

For example, the antenna cable sets listed below match the radio modules:

Order code	Description
AX0028	Antenna cable assembly TNCf-u.FL 135 mm
AX0030	Antenna cable assembly SMAf-u.FL 150 mm
AX0031	Antenna cable assembly MMCxf-u.FL 150 mm
AX0032	Antenna cable assembly MCXf-u.FL 150 mm
AX0228	Antenna cable assembly BNCf-u.FL 135 mm



2 SATEL-B2 TECHNICAL SPECIFICATIONS

The table below specifies the properties of SATEL-B2 motherboard assemblies.
The radio related specifications are presented in the integration guides of the radio modules.

SATEL-B2-TR4+ and SATEL-B2-TR489 comply with the following international standards:

- EN 300 113 (radio)
- EN 301 489 (EMC)
- IEC 62368 (safety)
- FCC CFR47 Part 90 (radio)
- FCC CFR47 Part 15 (EMC)

Additionally, SATEL-B2-TR489 comply with the following European standard:

- EN 300 220

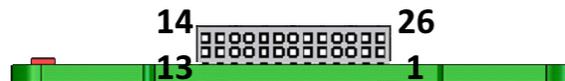
DATA INTERFACE	
Electrical Interface	Port 1: RS-232 Port 2: RS-232 (<i>Note.</i> “Diagnostics” for SL command purposes. Radio module GPIO2 must be set to mode 9, ON)
Interface Connector	SATEL-B2A: 26-pin horizontal female header connector (2x13-pin, pitch 1.27 mm) Part type: Weitronic 613-26-20-10-2-10
	SATEL-B2B: 26-pin vertical male header connector (2x13-pin, pitch 1.27 mm) Part type: Samtec FTSH-113-04-L-DV-A-P-TR (2 x 13 pin, pitch 1.27 mm)
GENERAL	
Operating voltages	+7 ...+27.5 VDC
Power Consumption	SATEL-TR4+ radio module installed: <1.3 W (Receive) <3.0 W (Transmit @ 0.5 W) <8.0 W (Transmit @ 1 W) SATEL-TR489 radio module installed: <1.2 W (Receive) <3.0 W (Transmit @ 0.5 W) <7.0 W (Transmit @ 1 W)
Temperature Ranges	-25 °C ... +55 °C The radio modules comply with the radio standards -30 °C ... +65 °C Functional -40 °C ... +75 °C Absolute min./max. -40 °C ... +85 °C Storage
Construction	Aluminium housing or board stack without housing

3 EXTERNAL INTERFACE & CONNECTORS

Depending on the assembly, terminal equipment is connected to one of the connectors presented below. The pinouts of the connectors are listed in the chapter *Connector pinouts*.

BOARD LEVEL ASSEMBLY (SATEL-B2 MP1) (includes SATEL-B2A motherboard)

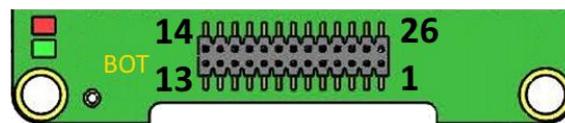
- Antenna cable is connected directly to the female u-Fl connector of the radio module
- External devices and power are connected to:



26-PIN HORIZONTAL FEMALE HEADER CONNECTOR (side view)
on the bottom side at the end of the motherboard
Part type: Weitronic 613-26-20-10-2-10 (2 x 13 pin, pitch 1.27 mm)

BOARD LEVEL ASSEMBLY (SATEL-B2 MP3) (includes SATEL-B2B motherboard)

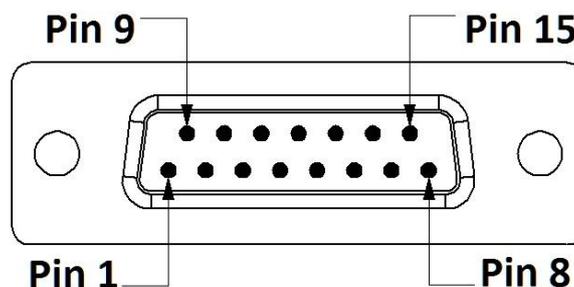
- Antenna cable is connected directly to the female u-Fl connector of the radio module
- External devices and power are connected to:



26-PIN VERTICAL MALE HEADER CONNECTOR (top view)
on the bottom side at the end of the motherboard
Part type: Samtec FTSH-113-04-L-DV-A-P-TR (2 x 13 pin, pitch 1.27 mm)

ENCLOSED ASSEMBLIES (SATEL-B2 ME1/ME2/ME3)

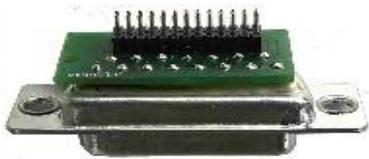
- Antenna (or antenna cable) is connected to the RF connector at other end of the metal enclosure (female TNC in ME1/ME2 assemblies, female BNC in ME3 assembly).
- External devices and power are connected to the female D15 connector:



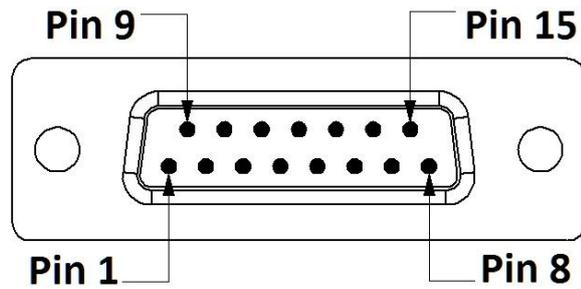
FEMALE D15 CONNECTOR pin numbering (front view)

BOARD LEVEL ASSEMBLY WITH D15 ADAPTER (SATEL-B2 MP2):

- Antenna cable) is connected directly to the female u-FI connector of the radio module.
- External devices and power are connected to the accompanying D15 adapter.



D15 ADAPTER



**FEMALE D15 CONNECTOR
pin numbering (front view)**



NOTE:

D15 adapter (KL0024, alias board name SPL0064b) must be installed carefully in the correct position! The slot in the board (encircled on the left) must be aligned with the edge of the motherboard.

3.1 Connector pinouts

SATEL-B2 ASSEMBLIES: 26-PIN HEADER & D15 CONNECTOR PINOUTS

"IN" is the direction of the signal from DTE (Data Terminal Equipment) to the radio module.
"OUT" is the direction of the signal from the radio module to DTE.

HEADER PIN	D15 PIN	NAME	I/O	LEVEL	EXPLANATION
1, 2, 3, 4	14, 15	VIN	IN	Power	Operating Voltage +7...27.5 VDC
5	13	RTS	IN	RS-232	Request To Send from DTE. <i>Note*)</i>
6	12	MODE	IN	0..27.5V	<1VDC or connected to ground: activates SERVICE pin of the radio module (Port1 = 38400 bps 8N1) >3VDC or Not connected = Normal data/command mode of the radio module is set active
7	11	TD1	IN	RS-232	Port1 Transmit Data from DTE to the radio module
8	10	DSR	OUT	RS-232	<i>Data Set Ready</i> indicates that radio module is ON.
9	9	RD1	OUT	RS-232	Port1 Receive Data to DTE from the radio module
10	-	RES	-	-	Reserved for future purposes
11	-	RES	-	-	Reserved for future purposes
12	-	RES	-	-	Reserved for future purposes
13	-	RES	-	-	Reserved for future purposes
14	-	GPIN	IN		General purpose input for specific purposes GPIN controls GPIO5-line of radio module
15	-	GPOUT	OUT		General purpose output for specific purposes GPOUT is controlled by GPIO8 line of radio module
16	-	RES	OUT	RS-232	Reserved for future purposes
17	1	DTR	IN	0..27.5V	Data Terminal Ready. The pin can be used to wake-up the radio module from the standby mode. >+3 VDC or not connected = ON, <+0.6 VDC = STANDBY
18	2	RES	OUT	RS-232	Reserved for future purposes
19	3	RD2	OUT	RS-232	Port2 Receive Data to DTE from the radio module
20	4	TD2	IN	RS-232	Port2 Transmit Data from DTE to the radio module
21	5	RES	IN	RS-232	Reserved for future purposes
22	6	CTS	OUT	RS-232	Clear To Send. Indicates that the radio module is ready to receive data from DTE. <i>Note*)</i>
23, 24, 25, 26	7, 8	GND	-		Operating voltage ground / signal ground. Galvanically connected to the enclosure (ME1/ME2/ME3 assemblies) and the mounting holes of the motherboard (MP1/MP2/MP3 assemblies)

NOTE: Unused pins should be left unconnected!

Note*) RTS and CTS signals apply to the Data port (Port1)

3.2 Power supply

SATEL B2 motherboard assembly must be connected to a power supply with an adequate current output. The power supply must provide current limiting against short circuits.

Operating voltage range	+7 ... +27.5 VDC
Current rating of the fuse	1.5 A

3.3 Serial ports

SATEL-B2 motherboard assemblies provide two separate serial ports:

- **Port 1** for data and control (SL commands)
- **Port 2** for control (SL commands), “Diagnostics”. Note: radio module GPIO2 must be set to mode 9 (ON).

Before connecting DTE (Data Terminal Equipment) to the radio modem, please make sure that the configuration matches the physical interface (electrical characteristics, timing, direction, interpretation of signals).

NOTE! When MODE line (26-pin header connector, Pin 6) is connected to ground, the radio module uses fixed serial port settings 38400bps, 8N1

3.4 General purpose input/output (GPIO) lines

SATEL-B2 assemblies provide one input line (GPIN) and one output line (GPOUT) for control signaling between the radio module and the external device:

- **GPIN** controls the status of GPIO5 input of the radio module
- **GPOUT** is controlled by the status of GPIO8 output of the radio module.

The functions can be assigned by configuring the mode of GPIO5/GPIO8 settings of the radio module. Please see the separate documentation on the available functions of the radio module’s GPIO interface.

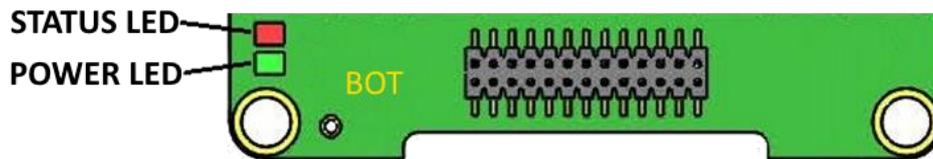
3.5 Antenna interface

The antenna should be always connected in its place when the power is on. Removing the antenna while the transmitter is on may damage the power amplifier inside the transmitter of the radio module. In case the antenna load is not 50 Ohms, the impedance matching should be placed in the host application.

3.6 LED indicators (board level SATEL-B2 assemblies MP1, MP2, M3)

The two LED indicators are located on the bottom side of the board as illustrated below.

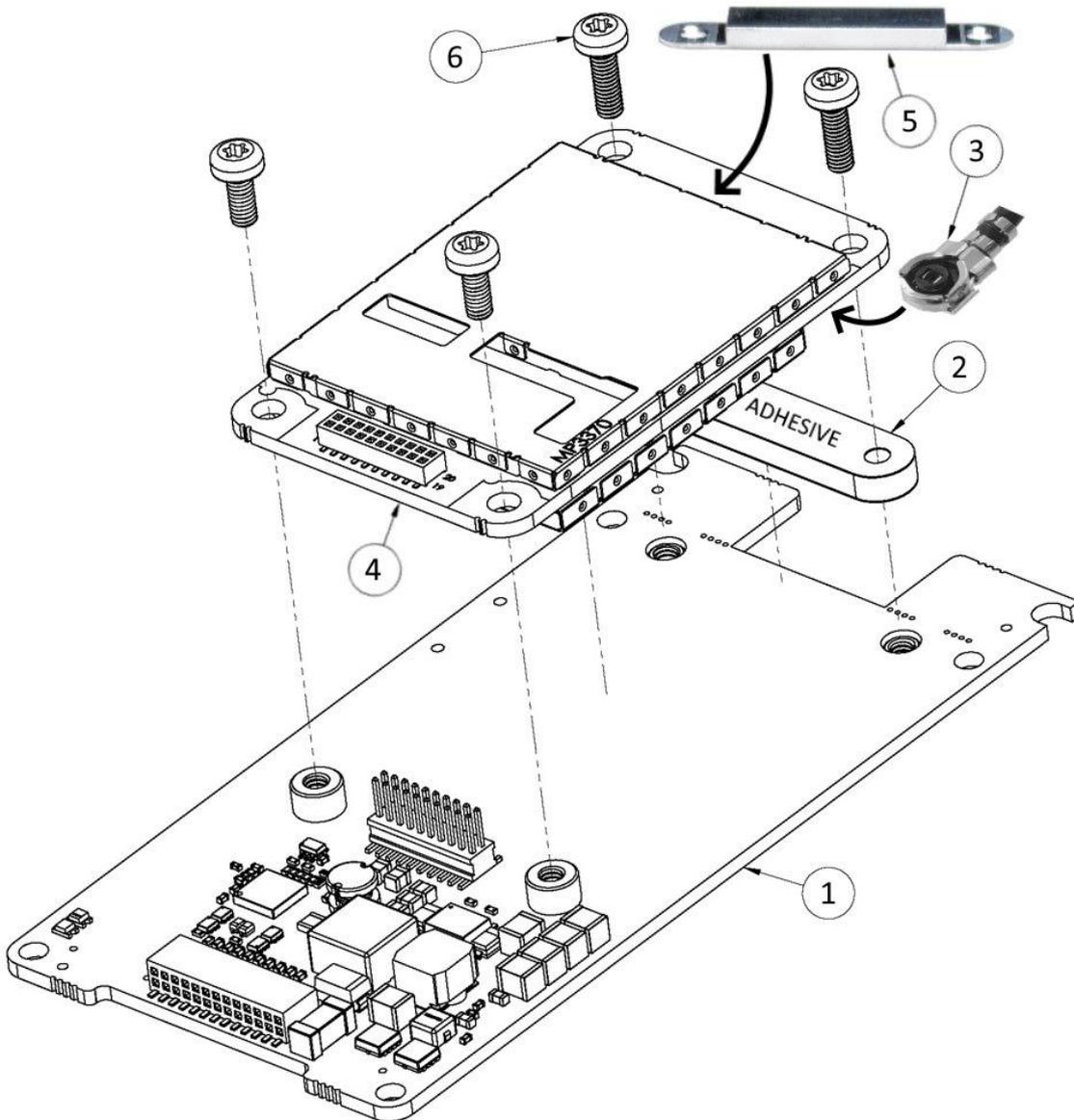
LED	Indication	OFF	Red	Red flashing	Green
POWER	Power indicator	Power OFF or Sleep	-	-	Power ON
STATUS	Reserved for various functions	Provision for special purposes			



4 HOW TO ASSEMBLE RADIO MODULE ON MOTHERBOARD

APPLIES TO BOARD LEVEL ASSEMBLIES (SATEL-B2 MP1/MP2/MP3)

The selected radio module is assembled on the motherboard as shown below.



CAUTION!

Integrated circuits can be damaged by electrostatic discharge (ESD). Precautions and proper handling procedures must be followed when handling or installing electrostatic-sensitive parts such as radio modules and motherboards.

Use proper anti-static protection:

- Avoid excessive handling of the parts or touching the circuits
- Ground personnel and workbench by using ground straps and conductive materials
- Use antistatic clothing, workwear and materials for storage and handling

Specific standards, such as IEC 61340-5-1 or ANSI/ESD S20.20 cover the subject in more details.

Assembly steps (*steps a and b are skipped if ME0909 is readily glued on the motherboard*)

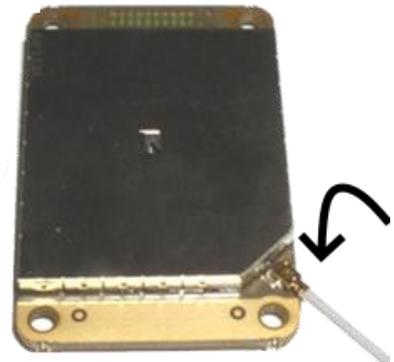
- a) Peel off one of the two plastic strips that protect the adhesive surfaces of the heat transfer block ME0909



- b) Align ME0909 (*item 2* in the picture on the previous page) carefully with the mounting holes of the motherboard (*item 1*), the peeled surface towards the motherboard, and press the items together so that the adhesive sticks

- c) Peel off the remaining plastic strip of ME0909 (*item 2*)

- d) Snap the antenna cable connector (*item 3*) to the u.FL connector of the radio module



- e) Attach the radio module (*item 4*) carefully as shown in the picture so that all the four mounting holes and the 20-pin header connector are aligned with the motherboard; then press gently so that the adhesive keeps the radio module aligned. Avoid pinching the antenna cable between the boards.

- f) OPTIONAL steps for the heat transfer block ME0910 (*item 5*):

- Peel off the plastic strip that protects the adhesive surface
- Attach as shown in the picture by aligning with the mounting holes and then pressing gently so that the adhesive sticks

ME0910 can be used for conducting the heat to an external cooling structure.

- g) Insert the four mounting screws (*items 6*) and tighten (1.5 Nm momentum)

5 INSTALLATION OF SATEL-B2 ASSEMBLIES

BOARD LEVEL ASSEMBLIES (SATEL-B2 MP1/MP2/MP3) are designed to be mounted inside a host device or an external enclosure. They can be mounted on the host structure by using spacers and screws (max diameter 3 mm). The dimensions of the assemblies are presented in the last chapters.

5.1 Considerations

Even though SATEL radio modules are designed to withstand interference beyond type approval requirements, some level of interference is inevitable when a small radio module is integrated closely to modern high speed electronics. The following issues should be considered in order to make a working integrated solution.

Electromagnetic interference (EMI) can enter the module in four ways:

- Via the antenna (radiation from enclosure enters the antenna)
- Radiated disturbances to the coaxial cable
- Radiation from other electronics / cabling directly to the module
- Conducting through the DTE interface (power, control and data lines).

Because the module is shielded and the serial interface is filtered, the disturbance comes most often via the antenna port, which is easily overlooked in design. Please keep in mind that the radio module has a sensitivity of approx. -115 dBm while the signal-to-noise requirement is approx. 10 dB. This means that any signal entering the radio antenna on the receiver frequency on the level above -125 dBm (far less than any EMC regulation states) causes desensitization of the receiver.

In order to avoid problems a good design should apply:

- EMI shielding in enclosure
- Careful layout design
- Shielding of all digital high speed parts and cables
- Avoid using clock frequencies that cause harmonics on the radio frequencies of interest.
- The most important is to recognize the challenge and act upon it early in the design phase.

Electrostatic discharge (ESD)

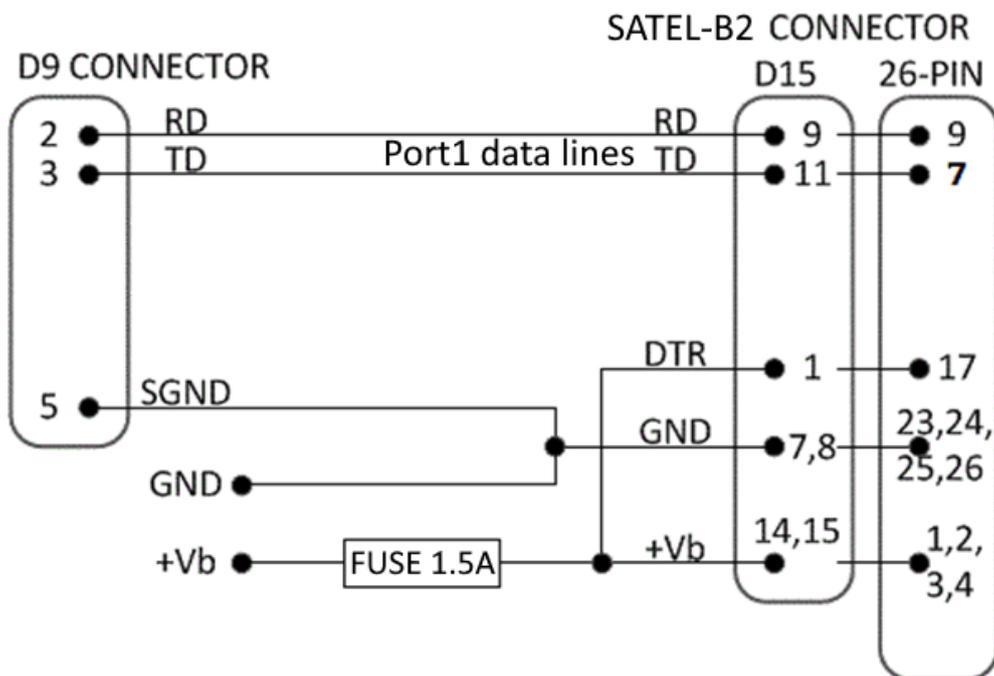
The module should be subject to ESD handling precautions that typically apply to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the module.

NOTE!

When selecting a suitable location for the radio modem it must be ensured that no water can get into the radio modem under any conditions. Direct sunlight is also to be avoided. It is not recommendable to install the radio modem on a strongly vibrating surface. Suitable dampening and/or isolation materials should be used in cases where the installation surface will be subjected to vibration.

5.2 Wiring

A typical wiring scheme for both the 26-pin connectors of SATEL-B2 MP1/MP3 assemblies and the D15 connector of SATEL-B2 ME1/ME2/ME3/MP2 assemblies is illustrated below.



NOTE!

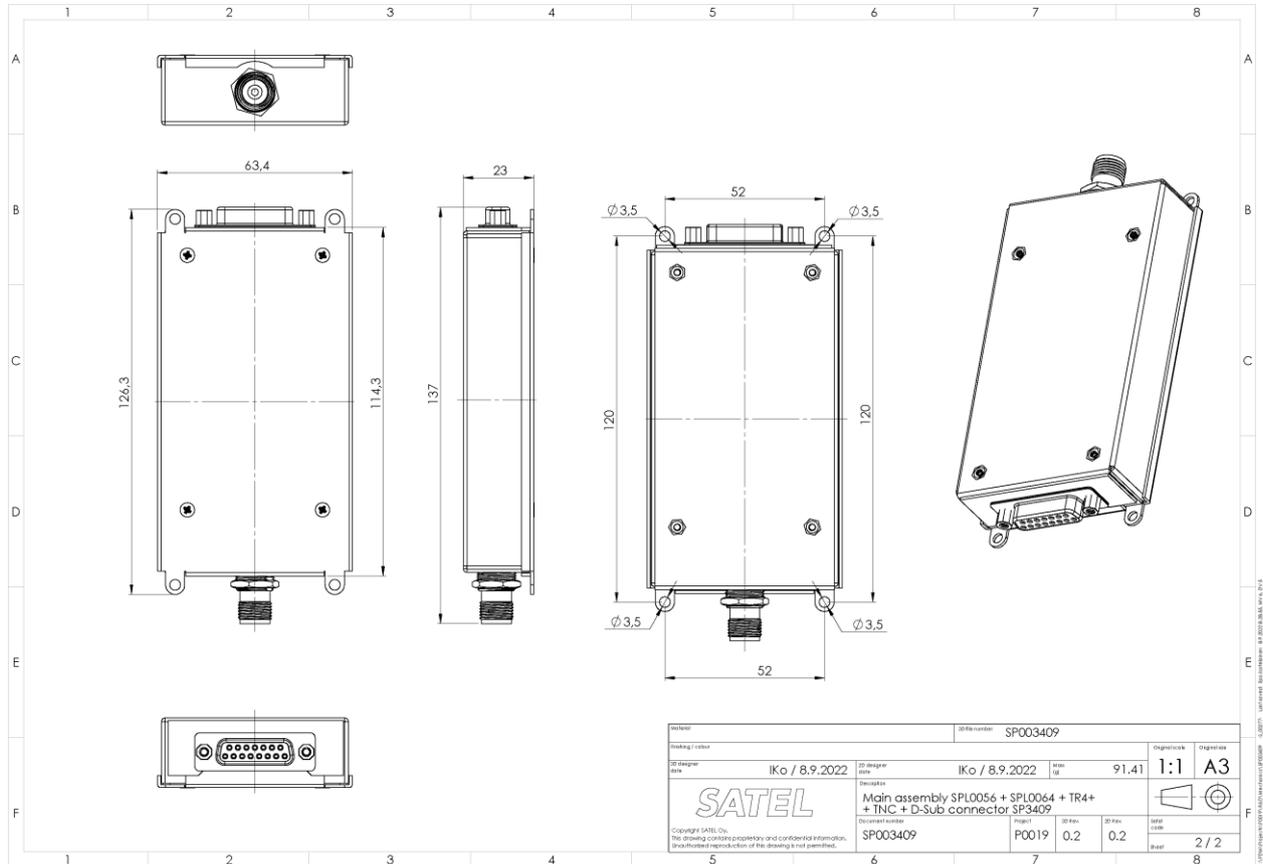
- When installing the cables of the serial interface, the operating voltage of all devices must be off (POWER OFF condition)
- The power supply must provide current limiting (FUSE 1.5A maximum size) against short circuits
- GND, the metal enclosure and the outer contact of the antenna connector are galvanically connected

6 CHECK LIST

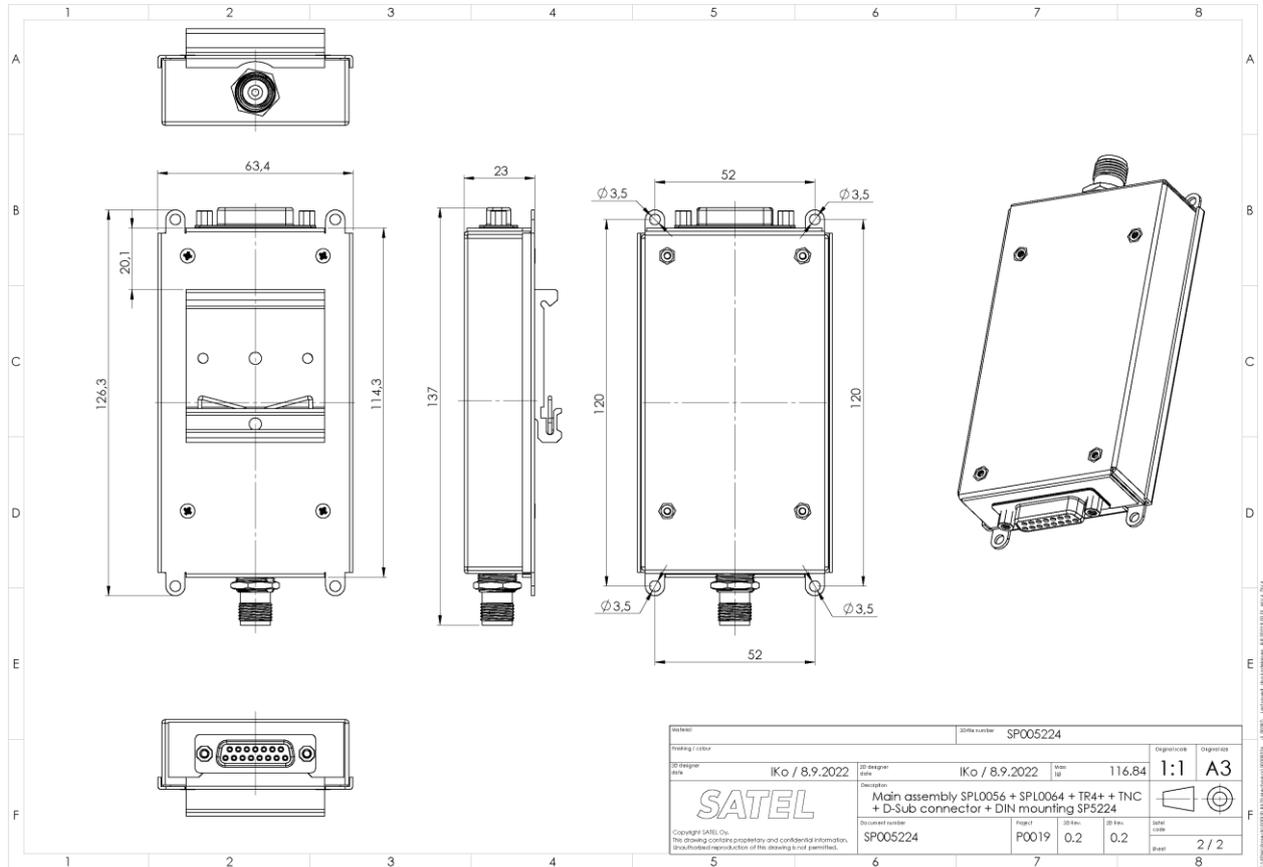
The following points must be taken into account when installing and configuring a radio modem:

1. All operating voltages of all the equipment concerned must always be switched OFF before connecting the serial interface cable.
2. When considering the exact placement of a radio modem and/or its antenna, the following points must be taken into account to guarantee optimal results:
 - The antenna should be installed in open space as far as possible from any possible sources of interference
 - The radio modem should not be installed onto a strongly vibrating surface
 - The radio modem should be installed in such a way as to minimise exposure to direct sunlight or excessive humidity.
3. To ensure reliable operation the voltage output of the power supply must be stable enough and the current capability of the power supply must be sufficient.
4. The antenna must be installed according to instructions.
5. Serial interface settings between the radio modem and the terminal unit must correspond to each other.
6. All radio modems in the same system must be configured using same settings (radio frequency, channel spacing and data field length).

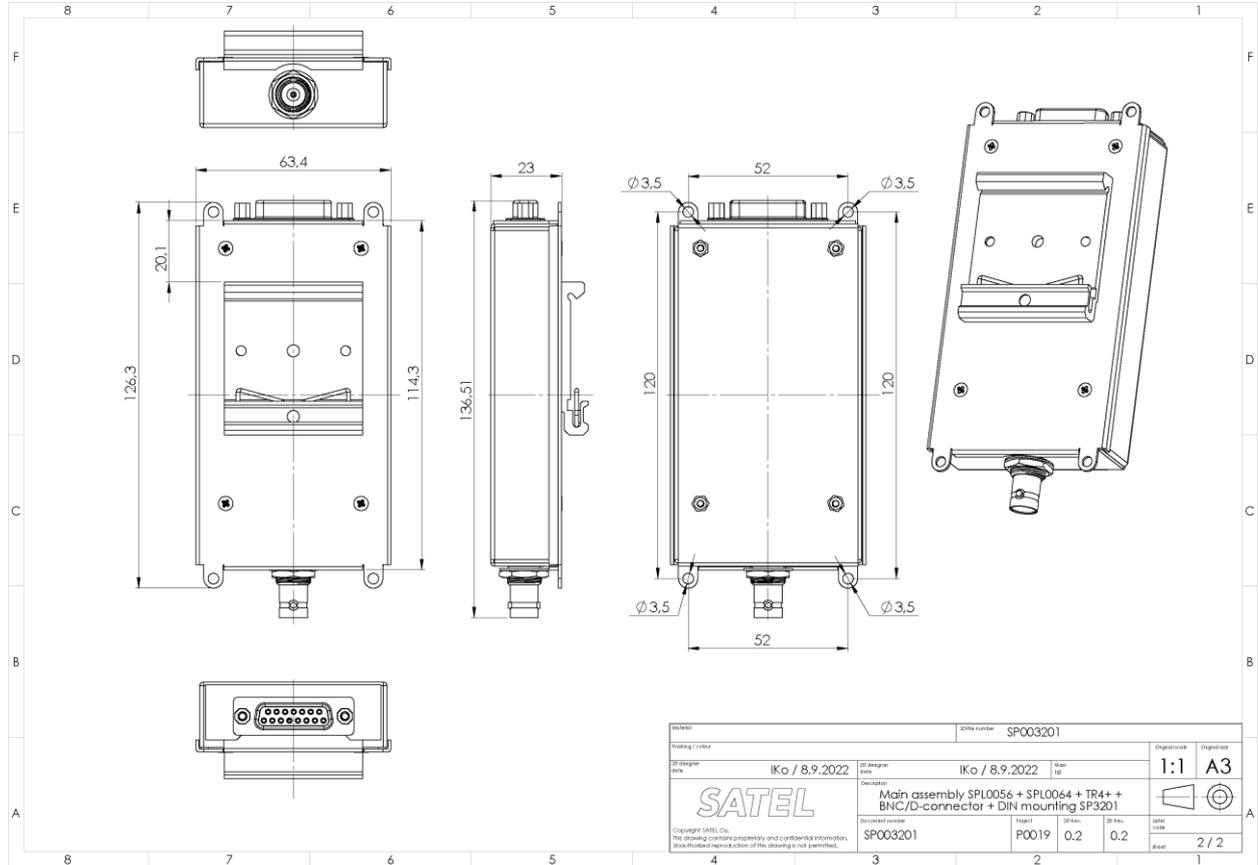
7 DIMENSIONS - SATEL-B2 ME1 ASSEMBLY



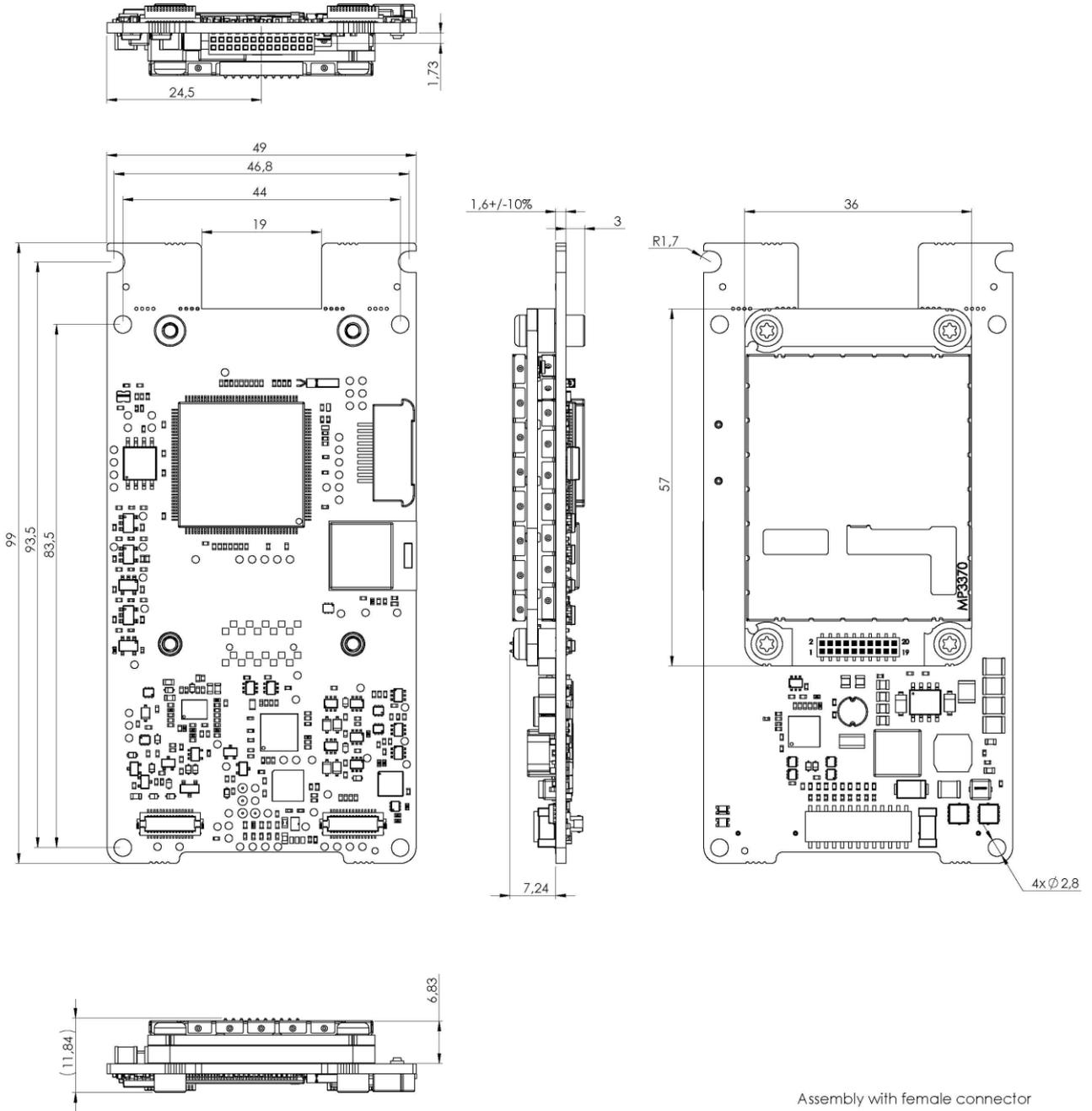
8 DIMENSIONS - SATEL-B2 ME2 ASSEMBLY



9 DIMENSIONS - SATEL-B2 ME3 ASSEMBLY



10 DIMENSIONS - SATEL-B2 MP1 ASSEMBLY



11 DIMENSIONS - SATEL-B2 MP3 ASSEMBLY

