# QuickSpot®

## Walter - WiFi/BLE/NB-IoT/LTE-M/GNSS module
Datasheet

# 1    General information

Walter is a small-form-factor IoT system-on-module (SoM) that combines a powerful ESP32-S3 system-on-chip (SoC) with a second-generation Sequans GM02SP LTE-M/NB-IoT 5G modem and GNSS receiver. Its ESP32-S3 provides many built-in peripherals as well, including UART, SPI, I²C, CAN, Wi-Fi b/g/n, and Bluetooth 5.

# 2    Features

Walter is based on an ESP32-S3-WROOM-1-N16R2 module with an on-board Sequans GM02SP modem. This combination makes Walter a unique development board that offers a rich feature-set which include but is not limited to:

- CPU: Xtensa Dual-core 32-bit LX7 CPU (ESP32-S3 SoC)

- RAM: 2MB (Quad SPI) PSRAM

- Flash: 16MB (Quad SPI) Flash memory

- WiFi: 150Mbps(n) 802.11 WiFi b/g/n with on-board antenna

- LTE: CAT M1/NB1/NB2 (GM02SP module)

- GPS: GPS, GNSS Constellation support (GM02SP module)

- Bluetooth: 2Mbps Bluetooth 5 (LE), Bluetooth Mesh

- 24 physical GPIO pins

- Ultra low deep sleep current of 9.8µA

- Open source software support for ESP-IDF, Arduino, Micropython and Toit

- Certified for CE, FCC, IC, UKCA, New-Zealand and Australia

- Solderless integration into any project due to the 2.54mm pin headers

# 3    Electrical characteristics

For the most reliable use and stability of the module we advice to use the typical ratings. We do not guarantee the correct functioning of the device outsite the minimum and maxium range of the module.

| Parameter | Units | Minimum rating | Typical rating | Maximum rating |
|---|---|---|---|---|
| DC Supply Voltage | V | 3.0 | 5.0 | 5.5 |
| Digital I/O Voltage | V | 2.64 | 3.3 | 3.6 |
| Power consumption @3.3V | A | – | – | 1.5 |
| 3.3V output current | A | – | – | 0.25 |
| Deep sleep current | µA | – | 9.8 | – |

# 4 Interfaces

Walter provides a total of 28 physical pins (3 power, 1 strapping pin and 24 I/O pins) to interface with external parts. This chapter provides information about these pins as well as internally connected pins and the testpoints located at the bottom of the board.

Power supply pins and their details are available in section 5.1 about the power characteristics.

For more information about specific pins regarding the ESP32-S3 Wroom module or the Sequans GM02SP module, please refer to the datasheet of the corresponding module.
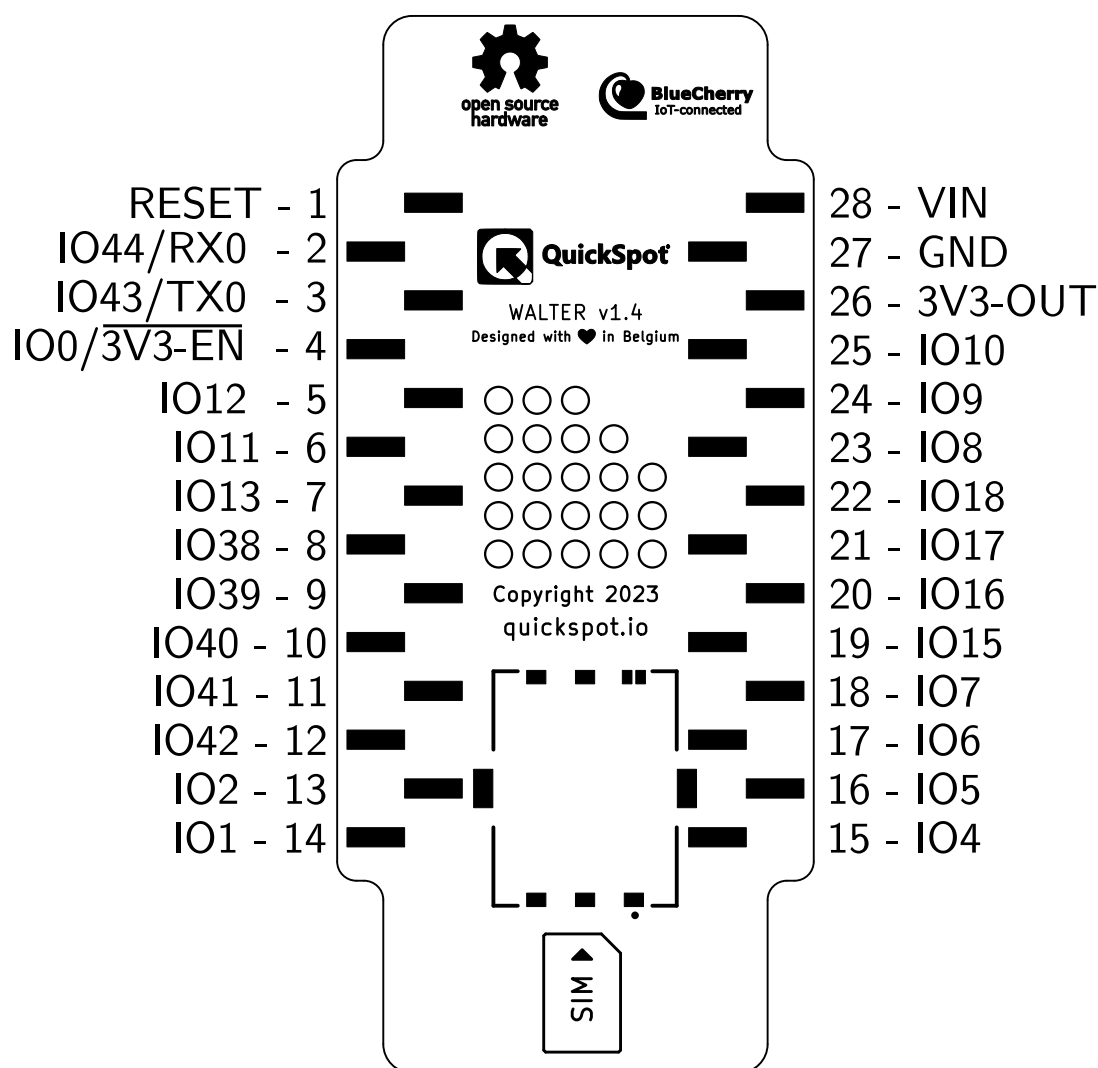
## 4.1 Pin Assignment



Figure 1: Walter pinout (top view)

### 4.1.1 External Pins

Table 1 contains the description of the physical pins on Walter available on the underside of the board. The order of this table, in reference to the board, is top to bottom and left to right.

| Pin | Function | ESP pin | Input/Output | Description |
|-----|----------|---------|--------------|-------------|
| 1 | RESET | EN | input | ESP32 reset with 10k pullup |
| 2 | IO44/RX0 | RXD0 | bidirectional | ESP32 UART0 Receive |
| 3 | IO43/TX0 | TXD0 | bidirectional | ESP32 UART0 Transmit |
| 4 | $\overline{DFU}/3V3\_EN$ | IO0 | bidirectional | DFU when low on boot and 3V3 output enable |
| 5 | IO12 | IO12 | bidirectional | General purpose I/O |
| 6 | IO11 | IO11 | bidirectional | General purpose I/O |
| 7 | IO13 | IO13 | bidirectional | General purpose I/O |
| 8 | IO38 | IO38 | bidirectional | General purpose I/O |
| 9 | IO39 | IO39 | bidirectional | General purpose I/O |
| 10 | IO40 | IO40 | bidirectional | General purpose I/O |
| 11 | IO41 | IO41 | bidirectional | General purpose I/O |
| 12 | IO42 | IO42 | bidirectional | General purpose I/O |
| 13 | IO2 | IO2 | bidirectional | General purpose I/O |
| 14 | IO1 | IO1 | bidirectional | General purpose I/O |
| 15 | IO4 | IO4 | bidirectional | General purpose I/O |
| 16 | IO5 | IO5 | bidirectional | General purpose I/O |
| 17 | IO6 | IO6 | bidirectional | General purpose I/O |
| 18 | IO7 | IO7 | bidirectional | General purpose I/O |
| 19 | IO15 | IO15 | bidirectional | General purpose I/O |
| 20 | IO16 | IO16 | bidirectional | General purpose I/O |
| 21 | IO17 | IO17 | bidirectional | General purpose I/O |
| 22 | IO18 | IO18 | bidirectional | General purpose I/O |
| 23 | IO8 | IO8 | bidirectional | General purpose I/O |
| 24 | IO9 | IO9 | bidirectional | General purpose I/O |
| 25 | IO10 | IO10 | bidirectional | General purpose I/O |
| 26 | 3V3 OUT | N/A | power output | Switchable 3.3VDC output |
| 27 | GND | GND | power ground | GND connection |
| 28 | VIN | N/A | power input | DC Power input port |

Table 1: Walter pin definitions

### 4.1.2    Internal Pins

Table 2 contains the pin descriptions of the internally connected GPIO pins on Walter. These are necessary for either communication between components on the board or reserved for other purposes and thus not available for external use.

| ESP pin | Description |
|:---:|:---|
| IO19 | USB D- |
| IO20 | USB D+ |
| IO46 | LTE_WAKE0 |
| IO48 | LTE_UART0_TX (See 4.2) |
| IO14 | LTE_UART0_RX (See 4.2) |
| IO21 | LTE_UART0_RTS (See 4.2) |
| IO47 | LTE_UART0_CTS (See 4.2) |
| IO45 | LTE_RESET |

Table 2: Walter Internal Pin Definitions

### 4.1.3    Testpoints

Walter contains 22 testpoints on the bottom of the board that serve multiple purposes. You can use these pins for debugging, interfacing and/or flashing of the Sequans GM02SP and the ESP32-S3-WROOM module.
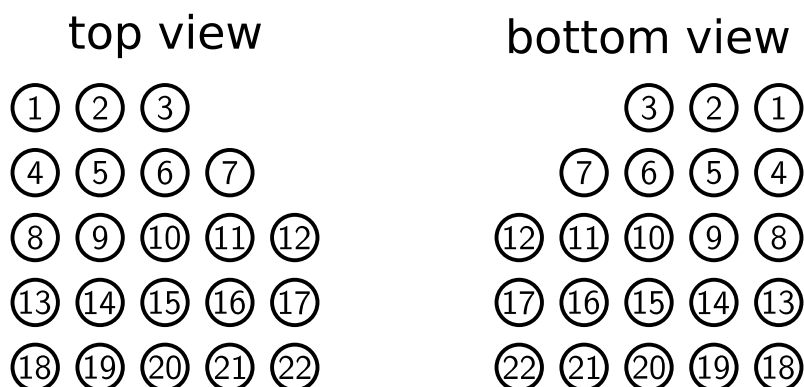


Figure 2: Walter testpoints

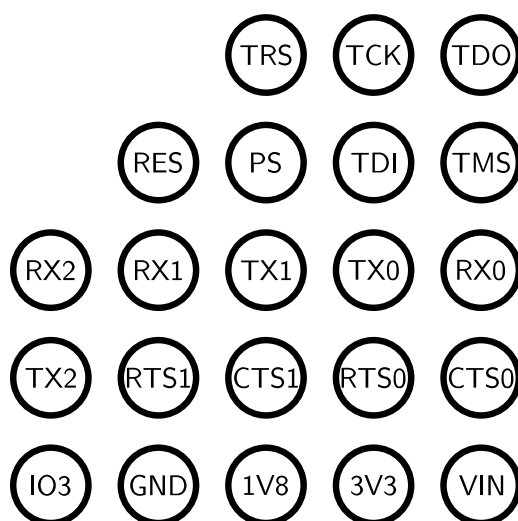| Number | Description |
|--------|-------------|
| 1 | Sequans GM02SP JTAG TDO |
| 2 | Sequans GM02SP JTAG TCK |
| 3 | Sequans GM02SP JTAG TRSTN |
| 4 | Sequans GM02SP JTAG TMS |
| 5 | Sequans GM02SP JTAG TDI |
| 6 | Sequans GM02SP PS status |
| 7 | Sequans GM02SP RES/FFF_FFH |
| 8 | Sequans GM02SP RX0 |
| 9 | Sequans GM02SP TX0 |
| 10 | Sequans GM02SP TX1 |
| 11 | Sequans GM02SP RX1 |
| 12 | Sequans GM02SP RX2 |
| 13 | Sequans GM02SP CTS0 |
| 14 | Sequans GM02SP RTS0 |
| 15 | Sequans GM02SP CTS1 |
| 16 | Sequans GM02SP RTS1 |
| 17 | Sequans GM02SP TX2 |
| 18 | Walter input power |
| 19 | 3V3 output (not switched) |
| 20 | Sequans GM02SP 1V8 output |
| 21 | Ground |
| 22 | ESP32-S3 GPIO3 (strapping pin) |

# bottom view



Figure 3: Bottom view of the Walter testpoints with their connection names.

### 4.1.4 Others

Not all pins of the ESP32-S3 and Sequans GM02SP on Walter are internally connected, available through physical pins or testpoints. These pins are either reserved for use by the component itself or deemed not necessary to be available externally.

## 4.2 Sequans GM02SP UARTs

The Sequans GM02SP module has 3 hardware UART interfaces. Only UART0 is connected to the ESP32-S3 Wroom Module on Walter as shown in Table 2. Communication between modules is possible with AT-commands. Please refer to the corresponding AT command reference manual of the Sequans GM02SP for all possible AT-commands. The UARTs have the following functionality by default:

- UART0 (115200@8N1 with HW handshaking): used for AT commands.

- UART1 (921600@8N1 with HW handshaking): used for manual firmware updates and/or custom software installation.

- UART2 (115200@8N1 no HW handshaking): console log output.

Please not that any UART host should be connected as follows:

- `RX <-> RX`

- `TX <-> TX`

- `RTS <-> RTS`

- `CTS <-> CTS`

# 5 Electrical and RF Characteristics

## 5.1 Power

### 5.1.1 Power Input

Walter can be powered either by connecting a USB-C cable or via the VIN pin (see pinout 4.1.1).

**DO NOT** power Walter with both the USB-C connection and the VIN-pin! This can lead to seriously damaging the board and external peripherals connected to it! To minimize losses the USB-C power input and Vin input pin are directly connected to each other. If you want to debug your application through USB-C while Walter is plugged into a carrier board we advise you to modify a USB-C cable by cutting the power lead.

### 5.1.2   Power Output

Walter contains a Texas Instruments TPS6208833 DC-DC Converter which takes power from either the USB-C port or the VIN-pin and converts it to a regulated +3.3VDC supply. The maximum load on the 3.3VDC output is 250mA.

### 5.1.3   Power Consumption

## 5.2   GPIO

All GPIO pins exposed via the physical pin headers on Walter are 3.3V resistant. If you want to connect 5V or other forms of logic, please use a suitable logic level converter or voltage divider.

Please reference the corresponding datasheets for all minimum, maximum and typical ratings of I/O pins of the ESP32-S3-WROOM or Sequans GM02SP Modules that may or may not be exposed on the Walter Development Board.
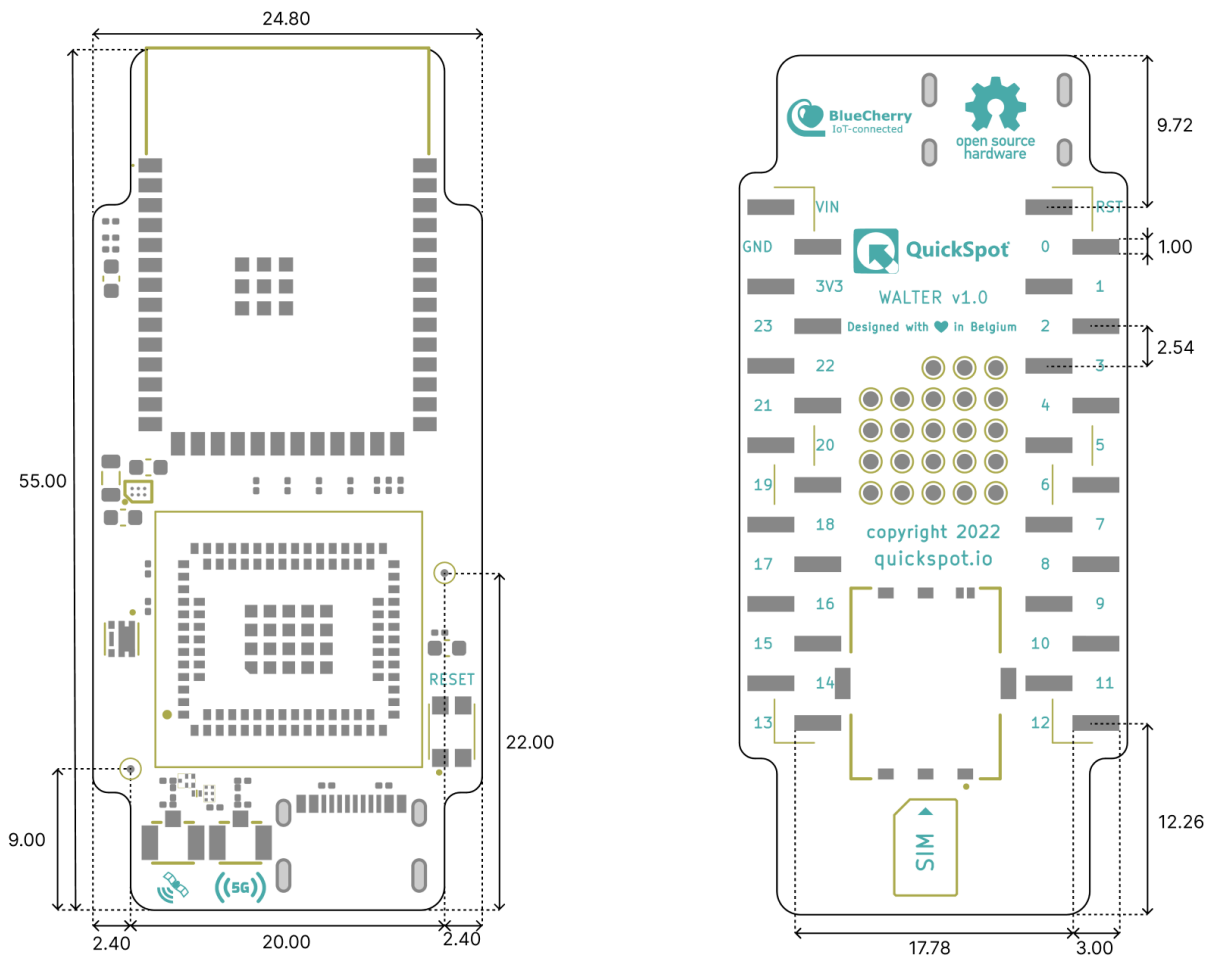
# 6 Mechanical information



Figure 4: Mechanical Drawing Front and Rear View - Unit in mm

# 7 Software

## 7.1 Libraries and frameworks from QuickSpot

Walter comes without firmware out of the box. You can easily program and upload your own firmware for Walter using MicroPython, Arduino, ESP-IDF... Please refer to the "Getting Started with Walter" available on our GitHub to get you up and running fast.

## 7.2 AT commands

The full set of supported AT commands can be found in the documentation of the Sequans GM02SP. This can be downloaded from this link: https://www.renesas.com/eu/en/document/mah/ryz024-modules-command-users-manual?language=en.

## 7.3 Manual SFU of the GM02SP

The second hardware UART of the GM02SP, namely UART1, is used for manual firmware upgrades. To do a manual serial SFU of the GM02SP in Walter you must connect UART1 via the testpads on the bottom of the module. Use an FTDI UART and make the following connections:

- Walter RX1 <-> FTDI RX

- Walter TX1 <-> FTDI TX

- Walter RTS1 <-> FTDI RTS

- Walter CTS1 <-> FTDI CTS

- Walter GND <-> FTDI GND

- Walter Vin <-> +5VDC

Make sure that the 5V power source which is powering Walter and the FTDI share a common ground. To enable smooth updating it is best not to connect the USB-C on Walter to the computer on which the SFU software is running. Now follow the instructions which are bundled with the SFU release.

# 8    Operating conditions

The module can operate in a wide range of temperatures and conditions. The following are guidelines in which the module is guaranteed to work correctly.

| Parameter | Units | Minimum rating | Typical rating | Maxium rating |
|---|---|---|---|---|
| Working temperature | °C | -40 | | 85 |
| Storage temperature | °C | -40 | | 100 |
| Humidity | %RH | 10 | | 90 |
| Storage humidity | %RH | 5 | | 90 |

Please note that no condensation may occur on the PCB and components.

# 9    Soldering profile

The Walter module can be reflow soldered with a low temperature profile.

# 10    Prohibited Use and Resale Statement

This electronics manual serves as a legal document outlining the terms of use and resale of the electronics herein described. By accessing, using, or reselling these electronics, you agree to abide by the terms outlined herein.

## 10.1    Prohibition on Resale to Third Countries

Users of these electronics are strictly prohibited from reselling them to third countries listed under the Export Control Classification Number (ECCN) or mentioned in Section 2.903 of the Federal Communications Commission (FCC) rules. Any such resale is considered a violation of export control regulations and may result in legal consequences.

## 10.2    Prohibition on Military Use

These electronics may not be used for military purposes without the prior written consent of the manufacturer. Any unauthorized use for military applications is strictly prohibited and may result in legal action.

## 10.3 Compliance with Applicable Local Laws

Users of these electronics are obligated to comply with all applicable local laws and regulations. This includes but is not limited to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862. Any use of these electronics for purposes contrary to local law is strictly prohibited.

## 10.4 Manufacturer's Liability

The manufacturer holds no liability for any misuse or unauthorized use of these electronics. Users assume full responsibility for their actions and agree to indemnify and hold harmless the manufacturer from any claims, damages, or liabilities arising from such misuse.

# 11 Certification

Walter has the following certifications:

- FCC ID: 2BDGUWALTER


- CE
- New Zealand and Australia

## 11.1 Federal Communication Commission Interference Statement

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.

2. This device must accept any interference received, including interference that may cause undesired operation.

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

**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.

## 11.2 RF warning statement

To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co–located or operating in conjunction with any other antenna or transmitter.

## 11.3    OEM integrator conditions

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users.

2. The transmitter module may not be co–located with any other transmitter or antenna.

As long as the two conditions above are met, further transmitter tests will not be required. However, the OEM integrator is still responsible for testing their end–product for any additional compliance requirements required with this module installed. To ensure compliance with all non–transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

The module is limited to OEM installation only. The module is limited to installation in a fixed application. We hereby acknowledge our responsibility to provide guidance to the host manufacturer in the event that they require assistance for ensuring compliance with the Part 15 Subpart B requirements.

**IMPORTANT NOTE**: In the event that these conditions cannot be met (for example certain laptop configurations or co–location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re–evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## 11.4    Antennas

The maximum LTE antenna gain values (accounting for cable attenuation) to comply with the FCC maximum ERP/EIRP limits and with RF Exposure rules:

- LTE band 2 (1900 PCS): 4.83 dBi
- LTE band 4 (AWS-1): 4.83 dBi
- LTE band 5 (850): 3.78 dBi
- LTE band 12 (700a): 0.36 dBi
- LTE band 13 (700c): 0.36 dBi
- LTE band 17 (700b): 0.36 dBi
- LTE band 25 (1900+): 4.83 dBi
- LTE band 66 (AWS-3): 4.83 dBi

- BLE/2.4 G WiFi: 3.26 dBi

An example of an approved LTE antenna is the Taoglas FXUB63.07.0150C.

An example of an approved GNSS antenna is the Taoglas FXP611.07.0092C.

## 11.5    Limited module procecures

Not applicable

## 11.6    Trace antenna designs

Not applicable

## 11.7   End product labelling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm must be maintained between the antenna and users. The final end product must be labelled in a visible area with the following: "Contains FCC ID: 2BDGUWALTER". The grantee's FCC ID can be used only when all FCC compliance requirements are met. The following FCC part 15.19 statement has to also be available on the label:

```
This device complies with Part 15 of 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.
```

## 11.8   Manual information to the end user

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. In the user manual of the end product, the end user has to be informed that the equipment complies with FCC radio–frequency exposure guidelines set forth for an uncontrolled environment. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. The end user manual shall include all required regulatory information/warning as show in this manual. The maximum operating ambient temperature of the equipment declared by the manufacturer is -40°C to +85°C.

# 12   Legal information

This module is manufactured by DPTechnics bv. We are not responsible for any product this module is part of. This datasheet is made with great care for detail but it is possible the datasheet will be updated with more accurate data in te future. Users of DPTechnics bv products can contact us by letter, telephone or email. For inquiries regarding the permissible use, resale, or any other questions related to these electronics, please contact the manufacturer. By using or reselling these electronics, you acknowledge that you have read and understood the terms outlined in this manual and agree to fully comply with them.

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