# GT864-QUAD / PY Hardware User Guide

1vv0300756 Rev.1 - 23/10/08


Making machines talk.

This document is relating to the following products:


| Model | P/N |
|---|---|
| GT864-QUAD | 4990150069 |
| GT864-PY | 4990150070 |

 

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# 1 Overview

The aim of this document is the description of some hardware solutions useful for developing a product with the **Telit GT864-QUAD/PY Terminal**.
In this document all the basic functions of a mobile phone will be taken into account; for each one of them a proper hardware solution will be suggested and eventually the wrong solutions and common errors to be avoided will be evidenced. Obviously this document cannot embrace the whole hardware solutions and products that may be designed. The wrong solutions to be avoided shall be considered as mandatory, while the suggested hardware configurations shall not be considered mandatory, instead the information given shall be used as a guide and a starting point for properly developing your product with the **Telit GT864-QUAD/PY Terminal**. For further hardware details that may not be explained in this document refer to the Telit GT864-QUAD/PY Product Description document where all the hardware information is reported.

**NOTICE**

*(EN) The integration of the GSM/GPRS* **GT864** *cellular module within user application shall be done according to the design rules described in this manual.*

*(IT) L'integrazione del modulo cellulare GSM/GPRS* **GT864** *all'interno dell'applicazione dell'utente dovrà rispettare le indicazioni progettuali descritte in questo manuale.*

*(DE) Die Integration des* **GT864** *GSM/GPRS Mobilfunk-Moduls in ein Gerät muß gemäß der in diesem Dokument beschriebenen Konstruktionsregeln erfolgen*

*(SL) Integracija GSM/GPRS* **GT864** *modula v uporabniški aplikaciji bo morala upoštevati projektna navodila, opisana v tem priročniku.*

*(SP) La utilización del modulo GSM/GPRS* **GT864** *debe ser conforme a los usos para los cuales ha sido diseñado descritos en este manual del usuario*

*(FR) L'intégration du module cellulaire* **GT864** *GSM/GPRS dans l'application de l'utilisateur sera faite selon les règles de conception décrites dans ce manuel*

(HE) האינטגרטור מתבקש ליישם את ההנחיות המפורטות במסמך זה בתהליך האינטגרציה של המודם הסלולרי GT864 עם המוצר.

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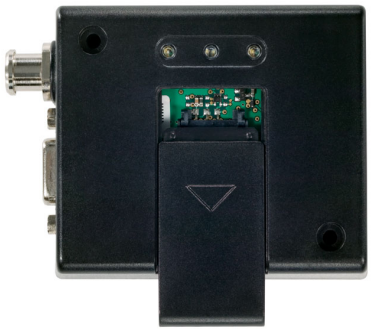
# 2 GT864 Terminal Interfaces

The interfaces of the **GT864 Terminal** are the following industry standard connectors distributed on the front and rear panels, see figures below.



- RJ11 6-way (power connector)
- Analog audio (GT864-QUAD only)
- 4 Input (GT864-PY only)
- SIM card reader
- FME male coaxial jack (antenna connector)
- Sub-D socket, 9 pin (RS232 serial port)

# 3 Power Supply

## 3.1 Supply voltage requirements

The DC power supply must be connected to the POWER input:

- Input voltage range 5 - 36V DC
- Nominal Voltage 12V DC

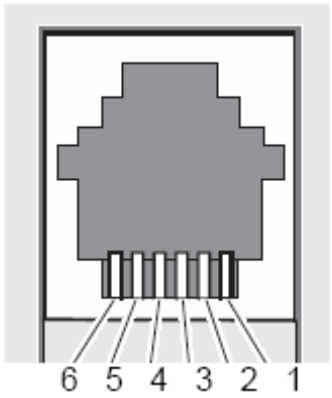
Application of the supply voltage does not switch the modem on. To do so an additional active-high control signal, TO_IN, must be applied for > 1s.
Please see chapter 3.3 Switching on the modem for further important details about TO_IN and power supply requirements, especially if TO_IN is applied in parallel to VCC.

VCC and GND are reverse-polarity and over-voltage protected. Please note: this does not apply for the GND on the antenna connector if this coax GND/shield is connected to your applications ground-plane.

**NOTE**: In case that power supply equipment is to be ordered, its conformity needs to be verified with the mains supply voltage, frequency, connector type and other national requirements (e.g. certifications) in the countries of its use.

### 3.1.1 Power Connector

An RJ11 6-way connector, as shown and described below, serves as a means of supplying and controlling DC power to the modem.



Pin description:

1 VCC
2 ADC_IN (not connected in GT864-QUAD Terminal)
3 HR_IN
4 TO_IN
5 DIG_OUT (not connected in GT864-QUAD Terminal)
6 GND

Signals of Power Connector:

| PIN | Signal | Direction | Limits | Description |
|---|---|---|---|---|
| 1 | VCC | Input | 5 – 36V | Positiv power input, DC |
| 2 | ADC_IN or not connected | Input | 0 – 36V | - No connection in GT864 Quad version<br>- Analogue Input in GT864 PY |
| 3 | HR_IN | Input | 5 – 36V | Active high control line used to switch off or reset the modem VIH > 5V,<br>VIL < 0.5V Power off: 1s < t < 2s |
| 4 | TO_IN | Input | 5 – 36V | Positive edge triggered signal; used to switch on the modem $V_{IH}$ > 5V, $V_{IL}$ < 0.5V Power on: t > 1s |
| 5 | DIG_OUT / or not connected | Output | 5 – 36V | - No connection in GT864 Quad version<br>- Digital Output in GT864 PY |
| 6 | GND | Input | - | Negative power (ground) input and return path for TO_IN and HR_IN |

## 3.1.2 Analogue Input GT864 PY Variant

The following command has to be used to initialise and to read the status of the analogue input:
AT#ADC=1,2,0

Response:

#ADC: <digital value> e.g. #ADC: 119
ADC_ IN ≈ 0,026V x digital value

Examples:

| ADC_IN [V] | 5V | 12V | 24V | 32V |
|---|---|---|---|---|
| digital value | 192 | 461 | 923 | 1230 |

### 3.1.3 Digital Output

- switch voltage is VIN; high side switch
- max. Output 400mA
- short circuit protected
- ESC protected
- under full control of embedded application

The following command has to be used to initialise and to set the digital output:

AT#GPIO=3,1,1 switch output on

AT#GPIO=3,0,1 switch output off

## 3.2 Power Consumption

The measurement was realised by 4 different Voltages (5 V, 12V, 24 V and 32 V). The Terminals were connected via RS232 cable with the PC in order to receive at commands. The temperatures were achieved with the help of temperature chamber. The voice call with Power level 5 in GSM 900 was established with a GSM Tester.

| GT864-QUAD | [mA] @ 5V | [mA]@12V | [mA] @ 24V | [mA] @ 32V |
|---|---|---|---|---|
| Terminal switched off | 0,075 | 0,520 | 1,770 | 2,580 |
| On, network connection (Idle mode) | 52 | 22 | 16 | 14 |
| On, network connection voice call (power level 5) GSM 900 | 203 | 86 | 41 | 40 |

| GT864-PY | [mA] @ 5V | [mA]@12V | [mA] @ 24V | [mA] @ 32V |
|---|---|---|---|---|
| Terminal switched off | 0,008 | 0,557 | 1,768 | 2,596 |
| On, network connection (Idle mode) | 61 | 26 | 17 | 17 |
| On, network connection voice call (power level 5) GSM 900 | 205 | 87 | 43 | 42 |

# 3.3 Switching the GT864 Terminal ON and OFF

In this paragraph will be explained the way to switch the GT864 Terminals ON or OFF.

There are two ways to switch on the modem, once power is applied.

- either assert TO_IN high for > 0.2s;
- or activate the RS232 control line DTR, high for > 0.2s.

The modem is fully operational after 4 seconds. Logging onto a network may take longer than this and is outside the control of the modem. The modem can be configured to start up at the time power is applied by permanently tying power connector signals TO_IN (pin 4) and VCC (pin 1) together. In this case DTR must be used to switch the modem on again after it has been switched off or reset, while power is still applied.

**NOTE:** DTR must be cycled from low to high.

**NOTE:** The TO_IN signal requires a positive “edge” (a “sharp” signal transition from low to high) to turn the modem on. This transition should be a rising signal from 0V (GND) to VCC, or at least a large fraction of that voltage range, and must be applied at the same time as VCC or after it. Very slow transitions (significantly slower than many milliseconds) or very small transitions (e.g. only a few volts instead of 0V to VCC) will not turn on the module (since they are not considered to be a “positive edge”).

Although this will not be an issue in almost all typical applications of the modem, under the following condition special design care has to be taken:

- large capacitors in your power supply which will lead to slow leading and falling edges (issue does not apply with modern stabilized switching regulator power-adaptors) AND TO_IN tied in parallel to VCC (instead of separate dedicated digital signal)
- slow analogue signals used to assert TO_IN
- TO_IN is asserted *before* VCC is asserted

All 3 cases above might prevent the modem from recognizing the power-up signal this is no failure of the modem itself, the same would apply to almost any electronic device that provides a separate “power-on” or “reset” signal.

If you are in doubt, please

- use the mains power adapter that is provided by your distributor and is known to work properly with your modem

or

- make sure that your signal and system design is according to the above

or

- consult our support team that will be more than happy to assist you.

There are three ways to switch off (power down) the modem as described below:

- either use the AT#SHDN command;
- HR_IN t=? (defined in the paragraph 3.1.1)
- DTR permanently to GND

A delay of up to 10s is experienced as the modem logs off the network

A full system reset, independent of the status of the software, may be applied to the modem as follows:

- HR_IN t=? (defined in the paragraph 3.1.1)

# 4 Mini USB type connector

There exist several different variants of the terminal module, all in (almost) the same housing, and all equipped with the mini USB-type connector:

- **Audio connector:** The GT864-QUAD Terminal provides "audio signals" on that connector, so you can connect a handset or microphone/speaker system here (available only for the GT864-QUAD)

- **GPIO:** The programmable GT864-PY provides digital inputs on that connector, so you can use external digital signals to control the behaviour of the terminal thereby (available only for the GT864-PY)

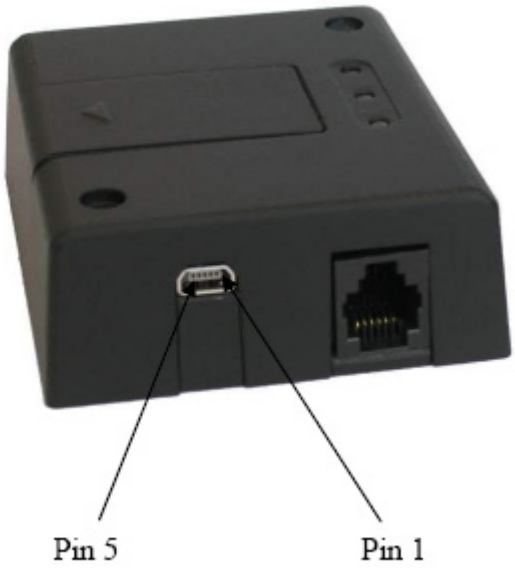
By their nature these 2 different signals are completely different regarding voltage levels, signal direction and applied energy. Especially the audio signals are quite sensitive to over-voltage, but are only protected against it to a limited extend, since otherwise the audio signal would be significantly detoriated. So please make sure you are using the right variant for your application and do not mix up different variants - **especially do not drive any digital signals into the USB-type-connector of the audio-variant, since that might seriously damage the device.**

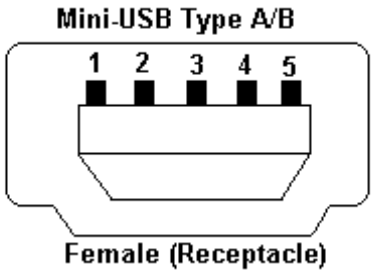
The USB connector supports the connectivity of a headset or any other audio equipment using the analogue microphone and loudspeaker interface of GT864-QUAD/PY Terminal. The table below describes the signals on the USB connector.

Pinning Mini USB connector GT864-QUAD :

| PIN | Signal |
|---|---|
| 1 | MIC - |
| 2 | EAR - |
| 3 | MIC + |
| 4 | EAR + |
| 5 | GND (not neccessary for audio) |




At the mini USB connector are 4 inputs, with the following technical description:

- max. voltage $V_{IN}$ is 30V
- low level: 0...1V
- high level: 4...30V
- ESD protected
- under full control of embedded application

Pinning of the USB connector for the GT864-PY:

| GT864-PY GPIO | GT864-PY PIN | Mini USB | Mini USB PIN |
|---|---|---|---|
| GPIO 11 | D1 | IN1 | 1 |
| GPIO 12 | G4 | IN2 | 2 |
| GPIO 13 | K10 | IN3 | 3 |
| GPIO 14 | B4 | IN4 | 4 |
| - | - | GND | 5 |

All inputs are under control of an embedded application script or AT commands.

The following AT commands have to be used to initialise and to read the status of the GPIOs:

AT#GPIO=11,2,0 (read GPIO11, PIN1 Mini USB)
AT#GPIO=12,2,0 (read GPIO12, PIN2 Mini USB)
AT#GPIO=13,2,0 (read GPIO13, PIN3 Mini USB)
AT#GPIO=14,2,0 (read GPIO14, PIN4 Mini USB)

# 5 Antenna

## 5.1 General

The antenna is the component in your system that maintains the radio link between the network and the modem. Since the antenna transmits and receives electromagnetic energy, its efficient function will depend on:

- the type of antenna (for example, circular or directional);
- the placement of the antenna;
- communication disturbances in the vicinity in which the antenna operates.

In the sections below, issues concerning antenna type, antenna placement, antenna cable, and possible communication disturbances are addressed. In any event, you should contact your local antenna manufacturer for additional information concerning antenna type, cables, connectors, antenna placement, and the surrounding area. You should also determine whether the antenna needs to be grounded or not. Your local antenna manufacturer might be able to design a special antenna suitable for your application.

### 5.1.1 Antenna type

Make sure that you choose the right type of antenna for the modem. Consider the following requirements:

- the antenna must be designed for the one of the frequency bands in use; please ask your network provider for more information:
  - GSM 850/900 MHz
  - GSM 1800/1900 MHz;
- the impedance of the antenna and antenna cable must be 50Ω;
- the antenna output-power handling must be a minimum of 2W;
- the VSWR value should be less than 3:1 to avoid any damage to the modem.

### 5.1.2 Antenna placement

The antenna should be placed away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas, operating in a similar radio frequency band, is at least 50cm. If signal strength is weak, it is useful to face a directional antenna at the closest radio base station. This can increase the strength of the signal received by the modem. The modem's peak output power can reach 2W. RF field strength varies with antenna type and distance. At 10cm from the antenna the field strength may be up to 70V/m and at 1m it will have reduced to 7V/m. In general, CE-marked products for residential and commercial areas, and light industry can withstand a minimum of 3V/m.

### 5.1.2.1 The antenna cable

Use 50Ω impedance low-loss cable and high-quality 50Ω impedance connectors (frequency range up to 2GHz) to avoid RF losses. Ensure that the antenna cable is as short as possible. The Voltage Standing-Wave Ratio (VSWR) may depend on the effectiveness of the antenna, cable and connectors. In addition, if you use an adapter between the antenna cable and the antenna connector, it is crucial that the antenna cable is a high-quality, low-loss cable. Minimize the use of extension cables, connectors and adapters. Each additional cable, connector or adapter causes a loss of signal power.

### 5.1.2.2 Antenna Connector

The **Telit GT864 Terminal** antenna connector allows transmission of radio frequency (RF) signals between the modem and an external customer-supplied antenna. The modem is fitted with a 50Ω FME male coaxial jack.

Description of antenna connector parameters:

| Parameter | Limit | Description |
|---|---|---|
| Nominal impedance | 50Ω (SWR better than 2.5:1) | |
| Output Power | Watt peak (Class 4)<br>1 Watt peak (Class 1) | Extended GSM900<br>GSM1800 |
| Static Sensitivity | Better than –102dBm<br>Better than –102dBm | Extended GSM900<br>GSM1800 |

# 6 Serial Ports

The RS232 standard interface serves to connect a PC, Data Terminal Equipment (DTE) or an application, which acts as host controller of the GT864 Terminal with all its functions. Through the RS232 interface it can be used as GSM/GPRS modem for sending and receiving of SMS, Data and Fax calls.

The **Telit GT864-PY**, on the basis of the EASY SCRIPT® feature and with a PYTHON script developed by the user, can allow self-controlled operations which put the RS232 interface in a different serial data transmission mode, e.g. to communicate with a sensor or actuator.

### 6.1.1 RS232 standard interface connector

Connector type on the terminal is:

- standard RS232 Sub-D 9pin female
- Baud rate from 300 to 115.200 bit/s
- Autobauding (300 to 38.400 bit/s)

The electrical characteristics of the serial port signals are shown below:

| PIN | Signal | Direction | Voltage levels | Description |
|---|---|---|---|---|
| 1 | DCD | Output | > + 4V<br><- 4 V | Data carrier detect |
| 2 | RD | Output | > + 4V<br><- 4 V | Received data |
| 3 | TD | Input | > + 2V<br>< 0.8 V | Transmitted data |
| 4 | DTR | Input | > + 2V<br>< 0.8 V | Data terminal ready |
| 5 | GND | - | 0 V | Ground connection |
| 6 | DSR | Output | > + 4V<br><- 4 V | Data set ready |
| 7 | RTS | Input | > + 2V<br>< 0.8 V | Request to send |
| 8 | CTS | Output | > + 4V<br><- 4 V | Clear to send |
| 9 | RI | Output | > + 4V<br><- 4 V | Ring indicator |

To connect to a PC as DTE, a pin-to-pin, 9 pin cable with D9 type connectors on both sides is needed (1 male & 1 female). Shielding of this cable is recommended and its length shall not exceed 3m.

# 7 Safety and Product Care

**Please read the information in this section and the information in "Installation of the Modem", before starting your integration work!**

## 7.1 General precautions

The GT864-QUAD/PY Terminal as a stand alone item is designed for indoor use only. To use outside it must be integrated into a weatherproof enclosure. Do not exceed the environmental and electrical limits as specified in "Technical Data".

- Avoid exposing the modem to lighted cigarettes, naked flames or to extreme hot or cold temperature.
- Never try to dismantle the modem yourself. There are no components inside the modem that can be serviced by the user. If you attempt to dismantle the modem, you may invalidate the warranty.
- The GT864-QUAD/PY Terminal must not be installed or located where the surface temperature of the plastic case may exceed 85°C.
- All cables connected to the GT864-QUAD/PY Terminal must be secured or clamped, immediately adjacent to the modem's connectors, to provide strain relief and to avoid transmitting excessive vibration to the modem in the installation.
- Ensure the d.c. cable, supplying power to the GT864-QUAD/PY Terminal, does not exceed 3 metres.
- To protect power supply cables and meet the fire safety requirements when the unit is powered from a battery or a high current supply, connect a fast 1.25A fuse in line with the positive supply.
- Do not connect any incompatible component or product to the GT864-QUAD/PY Terminal.

## 7.2 SIM card precautions

Before handling the SIM card in your application, ensure that you are not charged with static electricity. Use proper precautions to avoid electrostatic discharges.

- When the SIM card hatch is opened, the SIM card connectors lie exposed under the SIM card holder.

**Caution:** Do not touch these connectors! If you do, you may release an electrical discharge that could damage the modem or the SIM card.

- When designing your application, the SIM card's accessibility should be taken into account. We always recommend that you have the SIM card protected by a PIN code. This will ensure that the SIM card cannot be used by an unauthorized person.

## 7.3 Antenna precautions

If the antenna is to be mounted outside, consider the risk of lightning. Follow the instructions provided by the antenna manufacturer.

- Never connect more than one modem to a single antenna. The modem can be damaged by radio frequency energy from the transmitter of another modem.
- Like any mobile station, the antenna of the modem emits radio frequency energy. To avoid EMI (electromagnetic interference), you must determine whether the application itself, or equipment in the application's proximity, needs further protection against radio emission and the disturbances it might cause. Protection is secured either by shielding the surrounding electronics or by moving the antenna away from the electronics and the external signals cable.
- The modem and antenna may be damaged if either come into contact with ground potentials other than the one in your application. Beware, ground potential are not always what they appear to be.

# 8 Installation of the modem

This chapter gives you advice and helpful hints on how to integrate the GT864-QUAD/PY Terminal into your application from a hardware perspective. Please read the information given in “Safety and Product Care”, chapter 7 and then read the information in this section before starting your integration work.

## 8.1 Where to install the modem

There are several conditions which need to be taken into consideration when designing your application as they might affect the modem and its function. They are:

**Environmental conditions:** The modem must be installed so that the environmental conditions stated in the GT864-QUAD/PY Product Description, such as temperature, humidity and vibration are satisfied. Additionally, the electrical specifications in the Technical Data section must not be exceeded.

**GSM Signal strength:** The modem has to be placed in a way that ensures sufficient GSM signal strength. To improve signal strength, the antenna can be moved to another position. Signal strength may depend on how close the modem is to a radio base station. You must ensure that the location at which you intend to use the modem, is within the network coverage area. Degradation in signal strength can be the result of a disturbance from another source, for example an electronic device in the immediate vicinity. When an application is completed, you can verify signal strength by issuing the AT command AT+CSQ. See “AT+CSQ Signal Strength”.
**Tip:** Before installing the modem, use an ordinary mobile telephone to check a possible location for it. In determining the location for the modem and antenna, you should consider signal strength as well as cable length.

**Connections of components to GT864-QUAD/PY Terminal:** The integrator is responsible for the final integrated system. Incorrectly designed or installed, external components may cause radiation limits to be exceeded. For instance, improperly made connections or improperly installed antennas can disturb the network and lead to malfunctions in the modem or equipment.

**Network and Subscription:** Before your application is used, you must ensure that your chosen network provides the necessary telecommunication services. Contact your service provider to obtain the necessary information.

- If you intend to use SMS in the application, ensure this is included in your (voice) subscription.
- Consider the choice of the supplementary services

# 8.2 How to install the modem

## 8.2.1 Power supply

- Use a high-quality power supply cable with low resistance. This ensures that the voltages at the connector pins are within the allowed range, even during the maximum peak current.
- When the unit is powered from a battery or a high current supply, connect a fast 1.25A fuse in line with the positive supply. This protects the power cabling and modem.

## 8.2.2 Securing the modem

Before securing the modem take into account the amount of additional space required for the mating connectors and cables that will be used in the application.

- Where access is restricted, it may be easier to connect all the cables to the modem prior to securing it in the application.
- Securely attach the GT864-QUAD/PY Terminal modem to the host application using two 3mm diameter pan-head screws

# 9 SAFETY RECOMMANDATIONS

**READ CAREFULLY**

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc
- Where there is risk of explosion such as gasoline stations, oil refineries, etc

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity.

We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations.

The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force.

Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation EN 50360.

The European Community provides some Directives for the electronic equipments introduced on the market. All the relevant information's are available on the European Community website:

http://europa.eu.int/comm/enterprise/rtte/dir99-5.htm

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:

http://europa.eu.int/comm/enterprise/electr_equipment/index_en.htm

# 10 Conformity Assessment Issues

The GT864-QUAD/PY Terminal is assessed to be conform to the R&TTE Directive as stand-alone products, so If the module is installed in conformance with Dai Telecom installation instructions require no further evaluation under Article 3.2 of the R&TTE Directive and do not require further involvement of a R&TTE Directive Notified Body for the final product.

In all other cases, or if the manufacturer of the final product is in doubt then the equipment integrating the radio module must be assessed against Article 3.2 of the R&TTE Directive**.**
In all cases assessment of the final product must be made against the Essential requirements of the R&TTE Directive Articles 3.1(a) and (b), safety and EMC respectively, and any relevant Article 3.3 requirements.

The GT864-QUAD/PY Terminal is conform with the following European Union Directives:

- R&TTE Directive 1999/5/EC (Radio Equipment & Telecommunications Terminal Equipments)
- Low Voltage Directive 73/23/EEC and product safety
- Directive 89/336/EEC for conformity for EMC

  In order to satisfy the essential requisite of the R&TTE 99/5/EC directive, the GT864-QUAD/PY Terminal is compliant with the following standards:
- GSM (Radio Spectrum). Standard: EN 301 511 and 3GPP 51.010-1
- EMC (Electromagnetic Compatibility). Standards: EN 301 489-1 and EN 301 489-7
- LVD (Low Voltage Directive) Standards: EN 60 950

In this document and the Hardware User Guide, Software User Guide all the information you may need for developing a product meeting the R&TTE Directive is included.

# 11 Document Change Log

| Revision | Date | Changes |
|---|---|---|
| ISSUE #0 | 08/05/07 | Initial release |
| ISSUE #1 | 23/10/08 | Alligned with changes in Product Description |
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