Telit

GE863-GPS
GE863-PY
GE863-QUAD

Product Description

Telit Communications S.p.A

Contents

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1 Overview

The GE863 family is the evolution of the TRIZIUM family, which combines the access to digital communication services in GSM 850, 900, DCS 1800, PCS1900 MHz networks with additional options like an integrated GPS receiver.

The GE863 form factor is a surface mount, low profile compact shielded assembly provided with BGA solder connections, introduced with the former GE863 modules family. This form factor and mounting technology is reducing cost in high-volume applications, saveing space and weight in portable devices and with the GPS Option with EASY SCRIPT, it can form a self-controlled tracking device.

The GE863 module family consists of currently 3 models. Based on the standard model GE863-QUAD, the GE863-GPS integrates a highly sensitive 20-channel GPS receiver.
Moreover, the GE863-GPS and GE863-PY models, integrate the ***EASY SCRIPT*** functionality. This is a PYTHON engine script interpreter allowing self-controlled operations. With the ***EASY SCRIPT*** feature the GE863-GPS and GE863-PY become a finite product, it just needs your script to be run.

The Telit GE863 modules include all state-of-the-art features like GPRS Class 10, Voice Communication, Circuit Switched Data Transfer, Fax, Phonebook and SMS support, '***EASY GPRS***' embedded TCP/IP stack and '***EASY CAMERA***' external camera support and battery charging capabilities.
It is specifically designed and developed by Telit for OEM usage and dedicated to portable data, voice and telematic applications, such as:

- **Telemetry and Telecontrol**
- **Security systems**
- **Vending Machines**
- **POS terminals**
- **Mobile Computing**
- **Phones and Payphones**
- **Return channel for digital broadcasting**
- **Applications, where the external application processor can be replaced by the PYTHON engine provided by the GE863-GPS or GE863-PY**

Moreover, for the GE863-GPS:

- **Automotive and Fleet Management applications**
- **Position reporting and tracking with integrated GPS**

Other than the above mentioned feature, all three models support the following functionalities:

- ✓ ***EASY GPRS (AT driven embedded TCP/IP protocol stack, including FTP client)***
- ✓ ***EASY CAMERA (AT driven direct connection CAMERA function)***
- ✓ ***EASY SCAN (full GSM frequency scanning)***
- ✓ ***JAMMING DETECT & REPORT (detect the presence of disturbing devices)***

From the interface point of view, the GE863 provides the following:

- ✓ ***Full RS232 UART, CMOS level (ASC0) interface for AT commands:***
  - ***Auto-bauding from 2.4 up to 57.6 Kbps***
  - ***Fixed baud rate up to 115.2 Kbps***
- ✓ ***Two wires RS232, CMOS level (ASC1) for PYTHON debug:***
- ✓ ***SIM card interface, 3 and 1.8 volts***
- ✓ ***18 x GPIO ports (max)***
- ✓ ***3 x A/D converters, 12 bit resolution, 10 bit accuracy***
- ✓ ***1 x D/A converter (PWM output)***
- ✓ ***1 x buzzer output***
- ✓ ***1 x led status output indicator***

In order to meet the competitive OEM and vertical market stringent requirements, Telit supports its customers with a dedicated Technical Support Policy with:

- ❑ Telit Evaluation Kit EVK2 to help you to develop your application;
- ❑ a Website with all updated information available;
- ❑ a high level technical support to assist you in your development;

For more updated information concerning product Roadmap and availability, technical characteristics, commercial and other issues, please check on the Telit website www.telit.com > Products > Modules.

NOTE: Some of the performances of the **Telit GE863 modules** depend on the SW version installed on the module itself.
The **Telit GE863 SW** group is continuously working in order to add new features and improve the overall performances.
The **Telit GE863 modules** are easily upgradeable by the developer using the **Telit GE863 module** Flash Programmer.

2 General Product Description

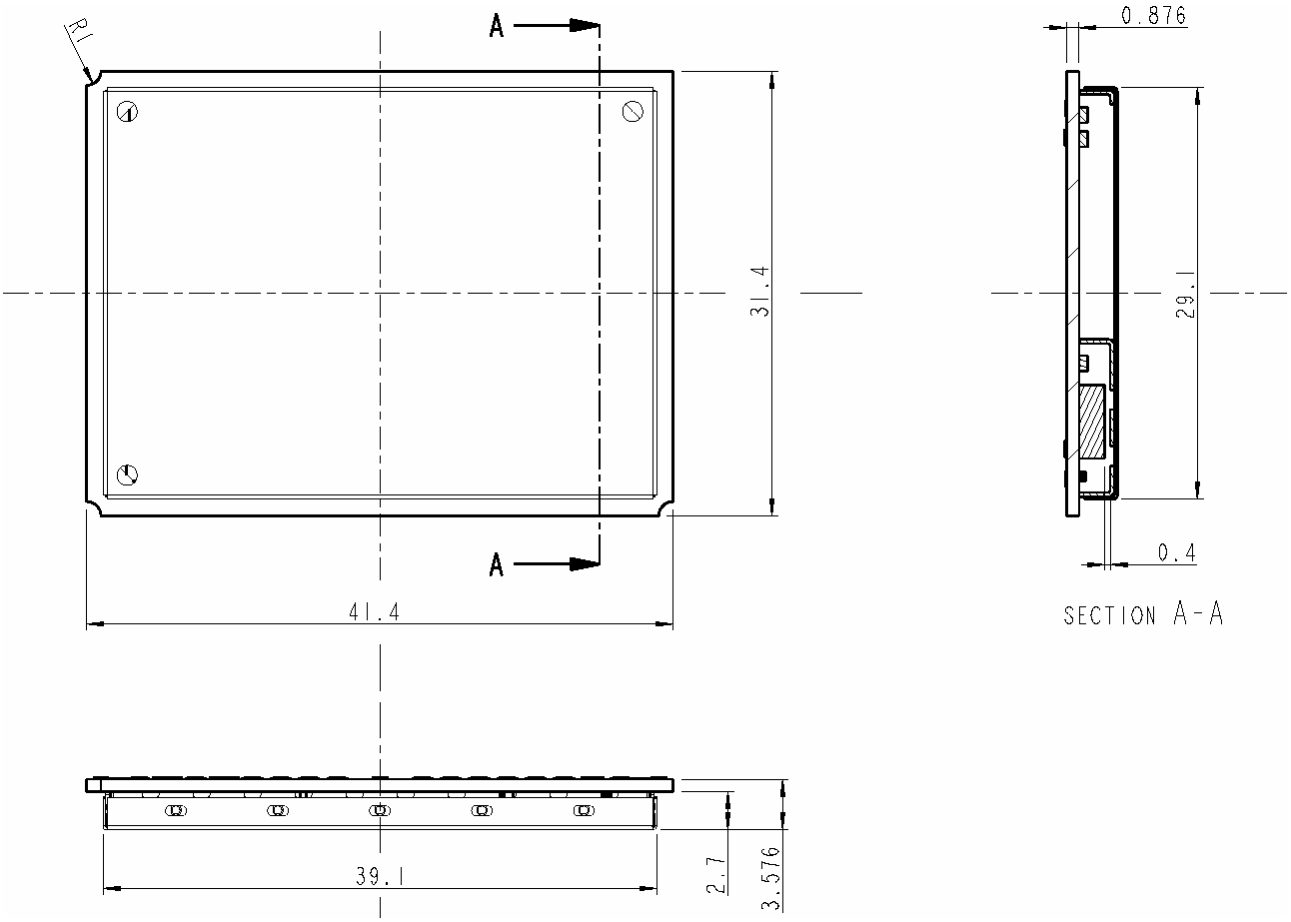
NOTE: The illustrations in this Product Description are only schematic and do not assure fidelity to construction or layout details, finishes, writings or colors.

2.1 Dimensions

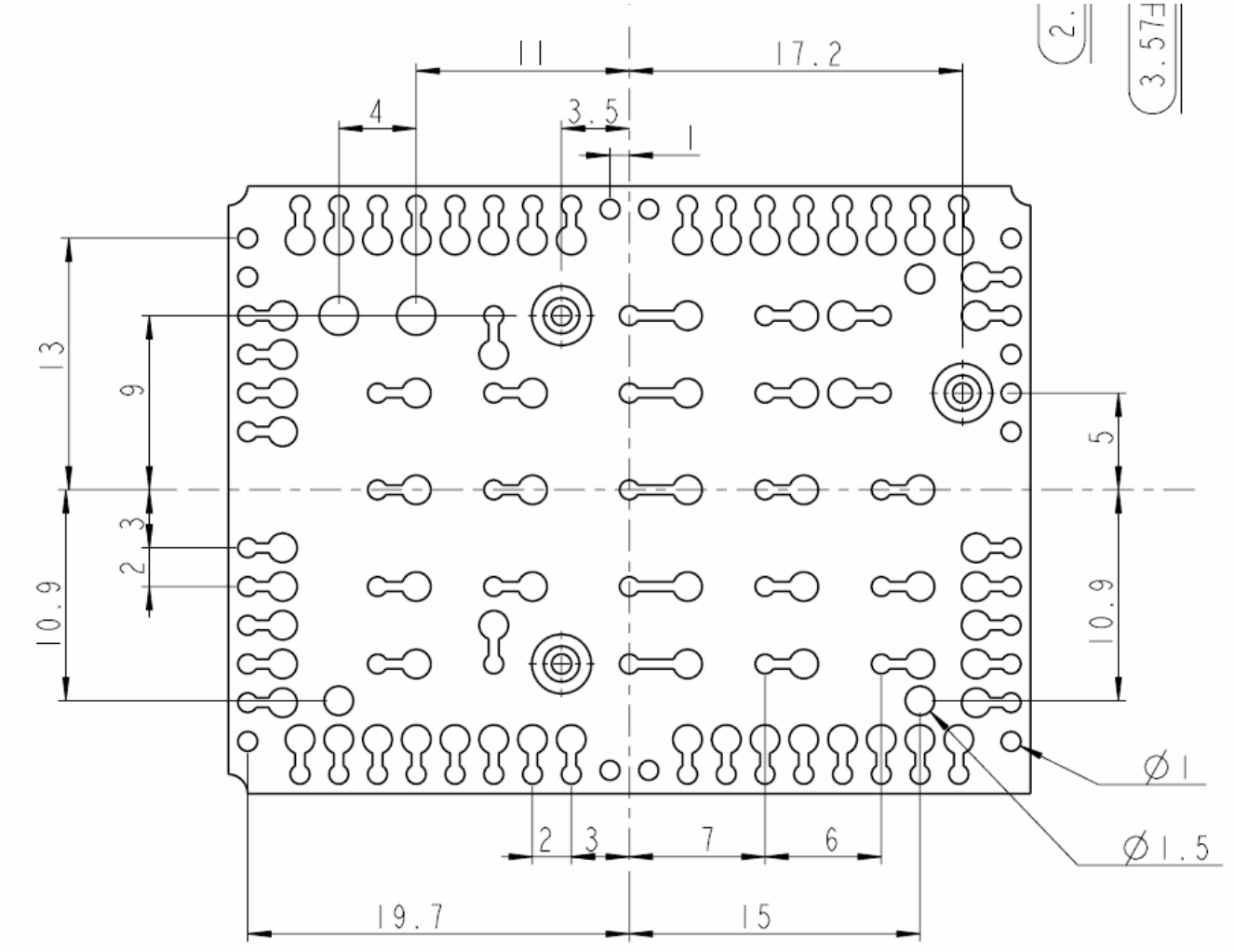
The Telit GE863 module overall dimensions are:

Length:	41,4 mm
Width:	31,4 mm
Thickness:	3,6 mm

The layout of the Telit GE863 module is shown in the following figure:



Top View



2.2 Weight

The Telit GE863 module weight is 9 gr.

2.3 Environmental requirements

The Telit GE863 module is compliant to the applicable ETSI reference documentation GSM 05.05 Release1998.

2.3.1 Temperature range

	GE863-QUAD / GE863-QUAD-PY	GE863-GPS
Temperature in normal operating conditions	–10°C ÷ +55°C	–10°C ÷ +55°C
Temperature in extreme operating conditions*	–30°C ÷ +80°C	–30°C ÷ +80°C (preliminary)
Temperature in storage conditions	–30°C ÷ +85°C	–30°C ÷ +85°C

* Temperature exceeding the range of normal functional conditions can affect the sensitivity, the performance and the MTBF of the module.

2.3.2 Vibration Test (non functional)

10 ÷12Hz ASD = 1.92m 2 /s 3
12 ÷ 150Hz –3dB/oct

2.3.3 RoHS compliance

The Telit GE863 module family is fully compliant to EU regulation on RoHS.

2.4 Operating Frequency

The operating frequencies in GSM, DCS, PCS modes are conform to the GSM specifications.

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels (ARFC)	TX - RX offset
E-GSM-900	890.0 - 914.8	935.0 - 959.8	0 – 124	45 MHz
	880.2 - 889.8	925.2 - 934.8	975 - 1023	
GSM-850	824.2 - 848.8	969.2 - 893.8	128 - 251	45 MHz
DCS-1800	1710.2 - 1784.8	1805.2 - 1879.8	512 – 885	95 MHz
PCS-1900	1850.2 - 1909.8	1930.2 - 1989.8	512 - 810	80 MHz

2.5 Transmitter output power

GSM–850 / 900

The Telit GE863 modules in GSM–850 / 900 operating mode are of **class 4** in accordance with the specification which determine the nominal **2W** peak RF power (**+33dBm**) on 50 Ohm.

DCS–1800 / PCS–1900

The Telit GE863 modules in DCS–1800/PCS–1900 operating mode are of **class 1** in accordance with the specifications, which determine the nominal **1W** peak RF power (**+30dBm**) on 50 Ohm.

2.6 Reference sensitivity

GSM–850 / 900
The sensitivity of the Telit GE863 modules according to the specifications for the class 4 GSM–850/900 portable terminals is **–107 dBm** typical in normal operating conditions.

DCS–1800 / PCS-1900
The sensitivity of the Telit GE863 modules according to the specifications for the class 1 portable terminals DCS-1800 / PCS-1900 is **–106 dBm** typical in normal operating conditions.

2.7 Antennas

2.7.1 GSM Antenna

The antenna that the customer chooses to use, should fulfill the following requirements:

Frequency range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s).
Bandwidth	70 MHz in GSM 850, 80 MHz in GSM 900, 170 MHz in DCS, 140 MHz PCS band
Gain	3 dBi > Gain > 1,5 dBi
Impedance	50 ohm
Input power	> 2 W peak power
VSWR absolute max	<= 10:1
VSWR recommended	<= 2:1

2.7.2 GPS Antenna

The active GPS antenna should fulfill the following requirements:

Frequency range	GPS L1 (1575.42 MHz),
Power supply	3 – 5 V DC
Gain	3 dBi > Gain > 1,5 dBi
Impedance	50 ohm

The supply voltage to the active GPS antenna is provided by the GE863-GPS.

2.8 GPS Module features

The GE863 include a SiRFstarIII™ single chip GPS receiver, that supports real-time location in urban area and wherever a high sensitivity acquisition is needed. As main features of such GPS receiver, we can mention:

- High sensitivity for indoor fixes
- Extremely fast TTFF's at low signal levels
- Hot starts < 2 seconds
- 200,000+ effective correlators
- Supports 20-Channel GPS

2.8.1 GPS Specifications

2.8.1.1 GPS Sensitivity

Type of Fix	Minimum Signal Strength (Signal Condition for all satellites)
Hot Start (first fix after standby)	- 159 dBm

2.8.1.2 GPS Consumption

The typical current consumption of the GPS part of the GE863-GPS module is:

Stand–by current	1 mA_{rms} ±20%
Operating current	70 mA_{rms} ±20%, including 50 mA for the GPS hardware and 20 mA for the antenna LNA

2.8.1.3 GPS Driving

The GPS functions are driven from the GSM Base Band processor trough a dedicated AT command set available in a separate specification.

2.8.1.4 GPS NMEA

The GPS data stream (NMEA 0183 format) is also available on the pin-out in RS232 8N1 format, 4800 bps (9600, 19200, 38400, and 57600 bps are available too)

2.8.1.5 NMEA sentences

The following GPS sentences are available:

GGA - essential fix data which provide 3D location and accuracy data.

```
$GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47
```

Where:

```
GGA          Global Positioning System Fix Data
123519       Fix taken at 12:35:19 UTC
4807.038,N   Latitude 48 deg 07.038' N
01131.000,E  Longitude 11 deg 31.000' E
1            Fix quality: 0 = invalid
                          1 = GPS fix (SPS)
                          2 = DGPS fix
                          3 = PPS fix
                          4 = Real Time Kinematic
                          5 = Float RTK
                          6 = estimated (dead reckoning) (2.3 feature)
                          7 = Manual input mode
                          8 = Simulation mode
08           Number of satellites being tracked
0.9          Horizontal dilution of position
545.4,M      Altitude, Meters, above mean sea level
46.9,M       Height of geoid (mean sea level) above WGS84
                 ellipsoid
(empty field) time in seconds since last DGPS update
(empty field) DGPS station ID number
*47          the checksum data, always begins with *
```

If the height of the geoid is missing then the altitude should be suspect. Some non-standard implementations report altitude with respect to the ellipsoid rather than geoid altitude. Some units do not report negative altitudes at all. This is the only sentence that reports altitude.

VTG - Velocity made good. The GPS receiver may use the LC prefix instead of GP if it is emulating Loran output.

```
$GPVTG,054.7,T,034.4,M,005.5,N,010.2,K
```

where:

```
VTG          Track made good and ground speed
054.7,T      True track made good
034.4,M      Magnetic track made good
005.5,N      Ground speed, knots
010.2,K      Ground speed, Kilometres per hour
```

Note that, as of the 2.3 release of NMEA, there is a new field in the VTG sentence at the end just prior to the checksum.

GSA - GPS DOP and active satellites. This sentence provides details on the nature of the fix. It includes the numbers of the satellites being used in the current solution and the DOP. DOP (dilution of precision) is an indication of the effect of satellite geometry on the accuracy of the fix. It is a unit less number where smaller is better. For 3D fixes using 4 satellites a 1.0 would be considered to be a perfect number, however for over determined solutions it is possible to see numbers below 1.0.
There are differences in the way the PRN's are presented which can effect the ability of some programs to display this data. For example, in the example shown below there are 5 satellites in the solution and the null fields are scattered indicating that the almanac would show satellites in the null positions that are not being used as part of this solution. Other receivers might output all of the satellites used at the beginning of the sentence with the null field all stacked up at the end. This difference accounts for some satellite display programs not always being able to display the satellites being tracked. Some units may show all satellites that have ephemeris data without regard to their use as part of the solution but this is non-standard.

```
$GPGSA,A,3,04,05,,09,12,,,24,,,,,2.5,1.3,2.1*39
```

Where:

```
GSA      Satellite status
A        Auto selection of 2D or 3D fix (M = manual)
3        3D fix - values include: 1 = no fix
                                  2 = 2D fix
                                  3 = 3D fix
04,05... PRNs of satellites used for fix (space for 12)
2.5      PDOP (dilution of precision)
1.3      Horizontal dilution of precision (HDOP)
2.1      Vertical dilution of precision (VDOP)
*39      the checksum data, always begins with *
```

GSV - Satellites in View shows data about the satellites that the unit might be able to find based on its viewing mask and almanac data. It also shows current ability to track this data. Note that one GSV sentence only can provide data for up to 4 satellites and thus there may need to be 3 sentences for the full information. It is reasonable for the GSV sentence to contain more satellites than GGA might indicate since GSV may include satellites that are not used as part of the solution. It is not a requirement that the GSV sentences all appear in sequence. To avoid overloading the data bandwidth some receivers may place the various sentences in totally different samples since each sentence identifies which one it is.
The field called SNR (Signal to Noise Ratio) in the NMEA standard is often referred to as signal strength. SNR is an indirect but more useful value that raw signal strength. It can range from 0 to 99 and has units of dB according to the NMEA standard, but the various manufacturers send different ranges of numbers with different starting numbers so the values themselves cannot necessarily be used to evaluate different units. The range of working values in a given GPS will usually show a difference of about 25 to 35 between the lowest and highest values, however 0 is a special case and may be shown on satellites that are in view but not being tracked.

```
$GPGSV,2,1,08,01,40,083,46,02,17,308,41,12,07,344,39,14,22,228,45*75
```

Where:

```
GSV          Satellites in view
2            Number of sentences for full data
1            sentence 1 of 2
08           Number of satellites in view
```

```
01          Satellite PRN number
40          Elevation, degrees
083         Azimuth, degrees
46          SNR - higher is better
            for up to 4 satellites per sentence
*75         the checksum data, always begins with *
```

RMC - NMEA has its own version of essential GPS PVT (position, velocity, time) data. It is called RMC, The Recommended Minimum, which will look similar to:

```
$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A
```

Where:

```
RMC          Recommended Minimum sentence C
123519       Fix taken at 12:35:19 UTC
A            Status A=active or V=Void.
4807.038,N   Latitude 48 deg 07.038' N
01131.000,E  Longitude 11 deg 31.000' E
022.4        Speed over the ground in knots
084.4        Track angle in degrees True
230394       Date - 23rd of March 1994
003.1,W      Magnetic Variation
*6A          The checksum data, always begins with *
```

Note that, as of the 2.3 release of NMEA, there is a new field in the RMC sentence at the end just prior to the checksum.

GLL - Geographic Latitude and Longitude is a holdover from Loran data and some old units may not send the time and data active information if they are emulating Loran data. If a GPS is emulating Loran data they may use the LC Loran prefix instead of GP.

```
$GPGLL,4916.45,N,12311.12,W,225444,A,*31
```

Where:

```
GLL          Geographic position, Latitude and Longitude
4916.46,N    Latitude 49 deg. 16.45 min. North
12311.12,W   Longitude 123 deg. 11.12 min. West
225444       Fix taken at 22:54:44 UTC
A            Data Active or V (void)
*31          checksum data
```

2.9 Supply voltage

The external power supply must be connected to VBATT signal pin and must fulfill the following requirements:

Nominal operating voltage	3.8 V
Operating voltage range	3.4 V – 4.2 V

Note: Operating voltage range must never be exceeded; care must be taken in order to fulfill min/max voltage requirements.

2.10 GSM Power consumption

The typical current consumption of GSM part of the Telit GE863 module is:

Power off current (typical)	< 26 μA;
Stand–by current (GSM Idle)	< 17 mA_{rms} (< 4 mA_{rms} using command AT+CFUN)
Operating current in voice channel	170 mA_{rms} @ typical network conditions
Operating current in voice channel	< 270 mA_{rms} 1.9 A_{peak} @ worst network conditions
Operating current in GPRS class 10	< 500 mA_{rms} @ worst network conditions

The total power consumption of GE863-GPS is the sum of the consumptions of GSM and GPS part.

2.11 Embodied Battery charger

The battery charger is suited for a 3.7V Li-Ion rechargeable battery (suggested capacity 500-1000mAH). The Charger needs only a CURRENT LIMITED power source input and charges the battery directly through VBATT connector pins.

Battery charger input pin	CHARGE
Battery pins	VBATT, GND
Battery charger input voltage min	5.0 V
Battery charger input voltage typical	5.5 V
Battery charger input voltage max	7.0 V
Battery charger input current max	400mA
Battery type	Li-Ion rechargeable

NOTE: If embodied battery charger is used, then a LOW ESR capacitor of at least 100μF must be mounted in parallel to VBATT pin.
NOTE: when power is supplied to the CHARGE pin, a battery must always be connected to the VBATT pins of the GE863.

2.12 User Interface

The user interface of Telit GE863 is managed by AT commands specified on the ITU-T V.250, GSM 07.07 and GSM 07.05 specifications.

2.12.1 Speech Coding

The Telit GE863 modules voice codec supports the following rates:

- Half Rate.
- Full rate,
- Enhanced Full Rate
- Adaptive Multi Rate

2.12.2 SIM Reader

The Telit GE863-PY and GE863-QUAD modules support phase 2 GSM11.14 – SIM 3V volts. Moreover, the GE863-GPS supports 1,8V SIM too. For 5V SIM cards, an external level translator can be added. All three models need an external SIM card holder.

2.12.3 SMS

The Telit GE863 modules support the following SMS types, in text and PDU mode:

- Mobile Terminated (MT) class 0 – 3 with signaling of new incoming SMS, SIM full, SMS read
- Mobile Originated class 0 – 3 with writing, memorize in SIM and sending
- Cell broadcast compatible with CB DRX with signaling of new incoming SMS.

2.12.4 Real Time Clock and Alarm

The Telit GE863 modules support the Real Time Clock and Alarm functions through AT commands; furthermore an alarm output pin (GPIO6) can be configured to indicate the alarm with a hardware line output.
Furthermore the Voltage Output of the RTC power supply is provided on a pin so that a backup capacitor can be added to increase the RTC autonomy.

2.12.5 Data/fax transmission

The Telit GE863 modules support:

- Packed Data transfer GPRS Class B, Multi-slot Class 10
- CSD up to 14.4 Kbps
- Fax service, Class 1 Group 3

2.12.6 Local security management

The local security management can be done by mean the lock of Subscriber Identity module (SIM), and security code request at power–up.

2.12.7 Call control

The call cost control function is supported.

2.12.8 Phonebook

Function available to store the telephone numbers in SIM memory. The capability depends on SIM version and therefore the embedded memory

2.12.9 Characters management

The GE863 support the IRA character set (International Reference Alphabet), in TEXT and PDU mode.

2.12.10 SIM related functions

The activation and deactivation of the numbers stored in phone book are supported, FDN, ADN and PINs too. The extension at the PIN2 for the PUK2 insertion capability for lock condition is supported too.

2.12.11 Call status indication

The call status indication by AT commands is supported.

2.12.12 Indication of network service availability

The STAT_LED pin status shows information on the network service availability and Call status.
In the GE863 modules, the STAT_LED usually needs an external transistor to drive the an external LED.
Therefore, the status indicated in the following table is reversed with respect to the pin status.

LED status	Device Status
Permanently off	Device off
Fast blinking (Period 1s, Ton 0,5s)	Net search / Not registered / turning off
Slow blinking (Period 3s, Ton 0,3s)	Registered full service
Permanently on	a call is active

2.12.13 Automatic answer (Voice, Data or FAX)

After a specified number of rings, the module will automatically answer with a beep. The user can set the number of rings by means of the command ATS0=<n>.

2.12.14 Supplementary services (SS)

The following supplementary services are supported:

- Call Barring,
- Call Forwarding,
- Calling Line Identification Presentation (CLIP),
- Calling Line Identification Restriction (CLIR),
- Call Waiting, other party call Waiting Indication,

- Call Hold, other party Hold / Retrieved Indication,
- Closed User Group supplementary service (CUG),
- Advice of Charge,
- Unstructured SS Mobile Originated (MO)

2.12.15 Acoustic signalling

The acoustic signals of Telit GE863 modules on the selected acoustic device are the following:

- ❑ Call waiting;
- ❑ Ringing tone;
- ❑ SMS received tone;
- ❑ Busy tone;
- ❑ Power on/off tone;
- ❑ Off Hook dial tone;
- ❑ Congestion tone;
- ❑ Connected tone;
- ❑ Call dropped;
- ❑ No service tone;
- ❑ Alarm tone.

2.12.16 DTMF tones

These tones are generated with AT commands only during voice calls.
The minimum duration of a DTMF tone is 100 ms.

Group low	Group high		
	1209 Hz	1336 Hz	1477 Hz
697 Hz	1	2	3
770 Hz	4	5	6
852 Hz	7	8	9
941 Hz	*	0	#

NOTE: The GSM system architecture defines that the audio signal of the DTMF tones is inserted by the network switches on commands sent by the Mobile Station (MS). Thus, the default duration parameters may vary from network to network. In case that the devices to be controlled by DTMF are sensitive related to the duration of the tones and timing of the sequences, dedicated investigations on the parameter settings have to be made.

2.12.17 Buzzer output

The General Purpose I/O pin GPIO7 can be configured to output the BUZZER output signal, with only an external MOSFET/transistor and a diode a Buzzer can be directly driven.
The ringing tone and the other signaling tones can be redirected to this Buzzer output with a specific AT command.

2.13 Logic level specifications

Where not specifically stated, all the interface circuits work at 2.8V CMOS logic levels.
The following table shows the logic level specifications used in the Telit GE863 modules interface circuits:

Absolute Maximum Ratings –Not Functional

Parameter	Min	Max
Input level on any digital pin when on	-0.3V	+3.75V
Input voltage on analog pins when on	-0.3V	+3.0 V

Operating Range – Interface levels (2.8V CMOS)

Level	Min	Max
Input high level	2.1V	3.3V
Input low level	0V	0.5V
Output high level	2.2V	3.0V
Output low level	0V	0.35V

For 2,0V signals:

Operating Range – Interface levels (2.0V CMOS)

Level	Min	Max
Input high level	1.6V	3.3V
Input low level	0V	0.4V
Output high level	1,65V	2.2V
Output low level	0V	0.35V

2.13.1 Reset signal

Signal	Function	I/O	BGA ball
RESET	Phone reset	I/O	47

The RESET is used to reset the Telit GE863 modules. Whenever this signal is pulled low, the GE863 is reset.
The Reset signal must be used only as an emergency exit in the rare case the device remains stuck waiting for some network response.

The RESET is internally controlled on start-up to achieve always a proper power-on reset sequence, so there's no need to control this pin on start-up. It may only be used to reset a device already on that is not responding to any command.

NOTE: do not use this signal to power off the Telit GE863 module. Use the ON/OFF signal (BGA Ball 46) to perform this function or the AT#SHDN command.

Reset Signal Operating levels:

Signal	Min	Max
RESET Input high	2.2V*	3.3V
RESET Input low	0V	0.2V

*this signal is internally pulled up so the pin can be left floating if not used.

If unused, this signal may be left unconnected. If used, then it **must always be connected with an open collector transistor**, to permit to the internal circuitry the power on reset and under voltage lockout functions.

2.14 RTC Bypass out

The VRTC pin brings out the Real Time Clock supply, which is separate from the rest of the digital part, allowing having only RTC going on when all the other parts of the device are off.
To this power output a backup capacitor can be added in order to increase the RTC autonomy during power off of the battery. NO Devices must be powered from this pin.

2.15 VAUX1 power output

A regulated power supply output is provided in order to supply small devices from the module.
This output is active when the module is ON and goes OFF when the module is shut down.
The operating range characteristics of the supply are:

Operating Range – VAUX1 power supply

	Min	Typical	Max
Output voltage	2.75V	2.85V	2.95V
Output current			100mA
Output bypass capacitor			2.2µF

2.16 Audio levels specifications

The audio of the Telit GE863 modules is organized into two main paths:

- Internal path (called also MT)
- External path (called also HF)

These two paths are meant respectively for handset and headset/hands-free use.
The Telit GE863 modules have a built in echo canceller and a noise suppressor, tuned separately for the two audio paths; for the internal path the echo canceller parameters are suited to cancel the echo generated by a handset, while for the external audio path they are suited for a hands-free use.

For more information on the audio refer to the GE863 Hardware User Guide.
The following table reports all the audio level specifications.

Microphone characteristics

	Internal audio mic. Input	**External audio mic. Input**
Line coupling	AC (100nF cond.)	AC (100nF cond.)
Line type	Balanced	Balanced
Differential input resistance	25kΩ	25kΩ
Line nominal sensitivity	$50mV_{rms \pm 2dB}$	$3mV_{rms \pm 2dB}$
Max input voltage	$360mV_{rms}$	$22mV_{rms}$
Microphone nominal sensitivity – Analog Gain suggested	$-45dB_{Vrms/Pa}$ -3dB / +24dB	$-45dB_{Vrms/Pa}$ -3dB / +10dB
Echo canceller type	handset	Car kit hands free

Speaker characteristics

	Internal audio ear. Output	**External audio ear. Output**
Line coupling	DC	DC
Line type	Bridged	Bridged
Speaker impedance	≥ 16Ω ± 5% @ 1kHz	≥ 16Ω ± 5% @ 1kHz
Minimun load impedance	15Ω	15Ω
Signal bandwidth	150-8000 Hz @ -3dB	150-8000 Hz @ -3dB
Maximum output	$1700mV_{rms}$	$850mV_{rms}$
Maximum power output	30mW	7.5mW
Volume level steps (SW)	-2dB	-2dB
Number of volume steps (SW)	10	10

2.17 Camera compatibility (EASY CAMERA)

The GE863-QUAD, PY and GPS provide a direct support for the camera whose characteristics are the following:

Model:	TRANSCHIP TC5747
Technology:	CMOS COLOR camera
Max picture size:	VGA 640x480 pixels
Output format:	JPEG
Sensitivity:	4V/lux-sec (including gain)

The camera will be directly managed by the hardware/software with some interface circuitry, providing a custom AT command interface to operate with it.

The AT commands of the module allows to take a snapshot and successively download it through the serial line.

Moreover, the GE863-QUAD and GE863-PY support the Agilent camera as per the previous TRIZIUM model.

2.18 Converter

2.18.1 ADC Converter

The on board ADCs are 11-bit converter. They are able to read a voltage level in the range of 0÷2 volts applied on the ADC pin input, and convert it into 11 bit word.

	Min	Max	Units
Voltage range	0	2	Volt
AD conversion	11	11	bits
Resolution	1	1	mV
Sampling rate	1 (idle)	60 (on traffic)	secs

2.18.2 DAC Converter

The on board DAC is able to generate a PWM signal based a specific percentage of duty cycle decided by the user. With the appropriate AT command, a value in the range from 0% up to 100% of duty cycle is issued. An external RF filter is necessary to convert the PWM signal into a constant voltage.

	Min	Max	Units
Voltage range	2.8	2.8	Volt
Duty Cycle range	0	100	%
Resolution	1	1	%

2.19 Board to Board interface of GE863 vs TRIZIUM

In the table below, the pin assignment of the GE863 is compared to the previous tri-band module Telit TRIZIUM and GE863.

The cells marked with yellow colour highlight the differences typically because more features are available on the newest models, except for the camera.

	TRIZIUM					GE863-QUAD, GE863-PY					GE863-GPS				
Pin	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type
1	PD5 / GPIO13	I/O	Port D5 / GPIO13 (4)		CMOS 2.8V	PD5 / GPIO13	I/O	Port D5 / GPIO13 (4)		CMOS 2.8V	GPIO13	I/O	GPIO13		CMOS 2.8V
2	PD4 / GPIO12	I/O	Port D4 / GPIO12 (4)		CMOS 2.8V	PD4 / GPIO12	I/O	Port D4 / GPIO12 (4)		CMOS 2.8V	GPIO12	I/O	GPIO12		CMOS 2.8V
3	PD3 / GPIO11	I/O	Port D3 / GPIO11 (4)		CMOS 2.8V	PD3 / GPIO11	I/O	Port D3 / GPIO11 (4)		CMOS 2.8V	GPIO11	I/O	GPIO11		CMOS 2.8V
4	PD2 / GPIO10	I/O	Port D2 / GPIO10 (4)		CMOS 2.8V	PD2 / GPIO10	I/O	Port D2 / GPIO10 (4)		CMOS 2.8V	GPIO10	I/O	GPIO10		CMOS 2.8V
5	PD1 / GPIO9	I/O	Port D1 / GPIO9 (4)		CMOS 2.8V	PD1 / GPIO9	I/O	Port D1 / GPIO9 (4)		CMOS 2.8V	GPIO9 / CAM_RST	I/O	GPIO9 / CAM_RST		CMOS 2.8V
6	PD0 / GPIO8	I/O	Port D0 / GPIO8 (4)		CMOS 2.8V	PD0 / GPIO8	I/O	Port D0 / GPIO8 (4)		CMOS 2.8V	GPIO8 / CAM_ON	I/O	GPIO8 / Camera Interface (CAM_ON)		CMOS 2.8V
7	MON1_CAM	O	Camera clock (4)		CMOS 2.8V	MON1_CAM	O	Camera clock (4)		CMOS 2.8V	CAM_CLK	I/O	Camera Interface (CLK)		CMOS 2.8V
8	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
9	EAR_MT-	AO	Handset earphone signal output, phase -		Audio	EAR_MT-	AO	Handset earphone signal output, phase -		Audio	EAR_MT-	AO	Handset earphone signal output, phase -		Audio
10	EAR_MT+	AO	Handset earphone signal output, phase +		Audio	EAR_MT+	AO	Handset earphone signal output, phase +		Audio	EAR_MT+	AO	Handset earphone signal output, phase +		Audio
11	EAR_HF+	AO	Handsfree ear output, phase +		Audio	EAR_HF+	AO	Handsfree ear output, phase +		Audio	EAR_HF+	AO	Handsfree ear output, phase +		Audio
12	EAR_HF-	AO	Handsfree ear output, phase -		Audio	EAR_HF-	AO	Handsfree ear output, phase -		Audio	EAR_HF-	AO	Handsfree ear output, phase -		Audio
13	MIC_MT+	AI	Handset microphone signal input; phase+, nominal level 50mVrms		Audio	MIC_MT+	AI	Handset microphone signal input; phase+, nominal level 50mVrms		Audio	MIC_MT+	AI	Handset microphone signal input; phase+, nominal level 50mVrms		Audio
14	MIC_MT-	AI	Handset microphone signal input; phase-, nominal level 50mVrms		Audio	MIC_MT-	AI	Handset microphone signal input; phase-, nominal level 50mVrms		Audio	MIC_MT-	AI	Handset microphone signal input; phase-, nominal level 50mVrms		Audio
15	MIC_HF+	AI	Handsfree microphone input; phase +, nominal level 3mVrms		Audio	MIC_HF+	AI	Handsfree microphone input; phase +, nominal level 3mVrms		Audio	MIC_HF+	AI	Handsfree microphone input; phase +, nominal level 3mVrms		Audio

	TRIZIUM					GE863-QUAD, GE863-PY					GE863-GPS				
Pin	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type
16	MIC_HF-	AI	Handsfree microphone input; phase -, nominal level 3mVrms		Audio	MIC_HF-	AI	Handsfree microphone input; phase -, nominal level 3mVrms		Audio	MIC_HF-	AI	Handsfree microphone input; phase -, nominal level 3mVrms		Audio
17	GND	-	Ground		POWER	GND	-	Ground		POWER	GND	-	Ground		POWER
18	SIMCLK	O	External SIM signal – Clock		3V ONLY	SIMCLK	O	External SIM signal – Clock		3V ONLY	SIMCLK	O	External SIM signal – Clock		**3V / 1.8V**
19	SIMRST	O	External SIM signal – Reset		3V ONLY	SIMRST	O	External SIM signal – Reset		3V ONLY	SIMRST	O	External SIM signal – Reset		**3V / 1.8V**
20	SIMIO	I/O	External SIM signal - Data		3V ONLY	SIMIO	I/O	External SIM signal - Data		3V ONLY	SIMIO	I/O	External SIM signal - Data		**3V / 1.8V**
21	CCIN	I	External SIM signal - Presence (active low)	47KOHM	CMOS 2.8V	CCIN	I	External SIM signal - Presence (active low)	47KOHM	CMOS 2.8V	SIMIN	I	External SIM signal - Presence (active low)	47KOHM	CMOS 2.8V
22	SIMVCC	-	External SIM signal – Power (3)		3V ONLY	SIMVCC	-	External SIM signal – Power (3)		3V ONLY	SIMVCC	-	External SIM signal – Power (3)		**3V / 1.8V**
23	ADC	AI	Analog/Digital converter input		A/D	ADC_IN1	AI	Analog/Digital converter input		A/D 0÷2 volt	ADC_IN1	AI	Analog/Digital converter input		A/D 0÷2 volt
24	VRTC	AO	VRTC Backup capacitor		Power	VRTC	AO	VRTC Backup capacitor		Power	VRTC	AO	VRTC Backup capacitor		Power
25	TX_TRACE	O	TX Data for debug monitor (1)		CMOS 2.8V	TX_TRACE	O	TX Data for debug monitor (1)		CMOS 2.8V	TX_TRACE	O	TX Data for debug monitor (1)		CMOS 2.8V
26	RX_TRACE	I	RX Data for debug monitor (1)		CMOS 2.8V	RX_TRACE	I	RX Data for debug monitor (1)		CMOS 2.8V	RX_TRACE	I	RX Data for debug monitor (1)		CMOS 2.8V
27	VBATT	-	Main power supply		Power	VBATT	-	Main power supply		Power	VBATT	-	Main power supply		Power
28	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
29	STAT_LED	O	Status indicator led		CMOS 2.8V	STAT_LED	O	Status indicator led		CMOS 2.8V	STAT_LED	O	Status indicator led		CMOS 2.8V
30	AXE	I	Handsfree switching	100 K	CMOS 2.8V	AXE	I	Handsfree switching	100 K	CMOS 2.8V	AXE	I	Handsfree switching	100 K	CMOS 2.8V
31	VOUT	O	Power output for external accessories (camera)		-	VAUX1	O	Power output for external accessories (camera)		-	VAUX1	O	Power output for external accessories (camera)		-
32	IICSDA GPIO4	I/O	Camera IIC interface / GPIO4 Configurable general purpose I/O pin (4)		CMOS 2.8V	IICSDA GPIO4	I/O	Camera IIC interface / GPIO4 Configurable general purpose I/O pin (4)		CMOS 2.8V	GPIO4 / CAM_SDA	I/O	GPIO4 / Camera IIC interface (SDA)		CMOS 2.8V
33	IICSCL GPIO2	I/O	Camera IIC interface / GPIO2 Configurable general purpose I/O pin (4) / JDR		CMOS 2.8V	IICSCL / GPIO2 / JDR	I/O	Camera IIC interface / GPIO2 Configurable general purpose I/O pin / JDR		CMOS 2.8V	GPIO2 / JDR	I/O	GPIO2 / JDR		CMOS 2.8V
34	GPIO1	I/O	GPIO1 Configurable general purpose I/O pin		CMOS 2.8V	GPIO1	I/O	GPIO1 Configurable general purpose I/O pin		CMOS 2.8V	GPIO1	I/O	GPIO1 Configurable general purpose I/O pin		CMOS 2.8V
35	CHARGE	AI	Charger input Power		Power	CHARGE	AI	Charger input Power		Power	CHARGE	AI	Charger input Power		Power
36	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
37	C103 / TXD	I	Serial data input (TXD) from DTE		CMOS 2.8V	C103 / TXD	I	Serial data input (TXD) from DTE		CMOS 2.8V	C103 / TXD	I	Serial data input (TXD) from DTE		CMOS 2.8V
38	C104 / RXD	O	Serial data output to		CMOS 2.8V	C104 / RXD	O	Serial data output to		CMOS 2.8V	C104 / RXD	O	Serial data output to		CMOS 2.8V

	TRIZIUM					GE863-QUAD, GE863-PY					GE863-GPS				
Pin	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type
			DTE					DTE					DTE		
39	C108 / DTR	I	Input for Data terminal ready signal (DTR) from DTE (4)		CMOS 2.8V	C108 / DTR	I	Input for Data terminal ready signal (DTR) from DTE (4)		CMOS 2.8V	C108 / DTR	I	Input for Data terminal ready signal (DTR) from DTE (4)		CMOS 2.8V
40	C105 / RTS	I	Input for Request to send signal (RTS) from DTE		CMOS 2.8V	C105 / RTS	I	Input for Request to send signal (RTS) from DTE		CMOS 2.8V	C105 / RTS	I	Input for Request to send signal (RTS) from DTE		CMOS 2.8V
41	C106 / CTS	O	Output for Clear to send signal (CTS) to DTE		CMOS 2.8V	C106 / CTS	O	Output for Clear to send signal (CTS) to DTE		CMOS 2.8V	C106 / CTS	O	Output for Clear to send signal (CTS) to DTE		CMOS 2.8V
42	C109 / DCD	O	Output for Data carrier detect signal (DCD) to DTE		CMOS 2.8V	C109 / DCD	O	Output for Data carrier detect signal (DCD) to DTE		CMOS 2.8V	C109 / DCD	O	Output for Data carrier detect signal (DCD) to DTE		CMOS 2.8V
43	C107 / DSR	O	Output for Data set ready signal (DSR) to DTE		CMOS 2.8V	C107 / DSR	O	Output for Data set ready signal (DSR) to DTE		CMOS 2.8V	C107 / DSR	O	Output for Data set ready signal (DSR) to DTE		CMOS 2.8V
44	C125 / RING	O	Output for Ring indicator signal (RI) to DTE		CMOS 2.8V	C125 / RING	O	Output for Ring indicator signal (RI) to DTE		CMOS 2.8V	C125 / RING	O	Output for Ring indicator signal (RI) to DTE		CMOS 2.8V
45	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
46	ON / OFF*	I	Input command for switching power ON or OFF (toggle command). The pulse to be sent to the GE863 must be equal or greater than 1 second.	47K	Pull up to VBATT	ON / OFF*	I	Input command for switching power ON or OFF (toggle command). The pulse to be sent to the GE863 must be equal or greater than 1 second.	47K	Pull up to VBATT	ON / OFF*	I	Input command for switching power ON or OFF (toggle command). The pulse to be sent to the GE863 must be equal or greater than 1 second.	47K	Pull up to VBATT
47	RESET*	I	Reset input	2K		RESET*	I	Reset input	2K		RESET*	I	Reset input	2K	
48	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
49	ANTENNA	O	Antenna output - 50 ohm RF		RF	ANTENNA	O	Antenna output - 50 ohm RF		RF	ANTENNA	O	Antenna output - 50 ohm RF		RF
50	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
51	OE_CAM / GPIO7	I/O	I/O Output Enable Camera / GPIO7 / BUZZER (4)		CMOS 2.8V	OE_CAM / GPIO7	I/O	I/O Output Enable Camera / GPIO7 / BUZZER (4)		CMOS 2.8V	GPIO7 / BUZZER	I/O	GPIO7 / BUZZER		CMOS 2.8V
52	PWR_CTL / CAM_SYNC	I/O	Camera Sync (4)		CMOS 2.8V	PWR_CTL / CAM_SYNC	I/O	Power ON Monitor / Camera Sync (4)		CMOS 2.8V	PWRMON	I/O	Power ON Monitor		CMOS 2.8V
53	CAM_DRDY / GPIO5	I/O	I/O Camera DRDY / GPIO5 (4)		CMOS 2.8V	CAM_DRDY / GPIO5	I/O	I/O Camera DRDY / GPIO5 (4) / RFTXMON		CMOS 2.8V	GPIO5	I/O	GPIO5 / RFTXMON		CMOS 2.8V
54	PD7 / GPIO6	I/O	Port D7 / GPIO6 (4)		CMOS 2.8V	PD7 / GPIO6	I/O	Port D7 / GPIO6 (4)		CMOS 2.8V	GPIO6	I/O	GPIO6 / ALARM		CMOS 2.8V

	TRIZIUM					GE863-QUAD, GE863-PY					GE863-GPS				
Pin	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type
55	PD6 / GPIO3	I/O	Port D6 / GPIO3 (4)		CMOS 2.8V	PD6 / GPIO3	I/O	Port D6 / GPIO3 (4)		CMOS 2.8V	GPIO3 / CAM_SCL	I/O	GPIO3 / Camera IIC Interface (SCL)		CMOS 2.8V
56	GND	-	Ground		Power	GND	-	Ground		Power	GND	-	Ground		Power
57	GND	-	Ground			RESERVED					RESERVED				
58	GND	-	Ground			RESERVED					RESERVED				CMOS 2.8V
59	GND	-	Ground			GPIO17	I/O	General Purpose Pin			GPIO17	I/O	General Purpose Pin		CMOS 2.8V
60	GND	-	Ground			GPIO14	I/O	General Purpose Pin			GPIO14	I/O	General Purpose Pin		CMOS 2.8V
61	GND	-	Ground			RESERVED					RESERVED				CMOS 2.8V
62	GND	-	Ground			RESERVED					RESERVED				
63	GND	-	Ground			DAC_OUT	O	PWM DAC output		CMOS 2.8V, an external RC filter is needed	DAC_OUT		PWM DAC output		CMOS 2.8V, an external RC filter is needed
64	GND	-	Ground			GPIO16	I/O	GPIO16		CMOS 2.8V	GPIO16	I/O	GPIO16		CMOS 2.8V
65	GND	-	Ground			RESERVED					RESERVED				CMOS 2.8V
66	GND	-	Ground			RESERVED					RESERVED				CMOS 2.8V
67	GND	-	Ground			GND	-	Ground			GND	-	Ground		Power
68	GND	-	Ground			RESERVED					TX_GPS	-	TX GPS NMEA data		
69	GND	-	Ground			GND	-	Ground			GND	-	Ground		Power
70	GND	-	Ground			ADC_IN3		Third ADC pin			RESERVED				
71	GND	-	Ground			GPIO15	I/O	General Purpose Pin			GPIO15	I/O	General Purpose Pin		CMOS 2.8V
72	GND	-	Ground			GND	-	Ground			GND	-	Ground		Power
73	GND	-	Ground			RESERVED	-				RX GPS	-	RX GPS NMEA data		CMOS 2.8V
74	GND	-	Ground			ADC_IN2	TBAT	Second ADC pin			RESERVED				
75	GND	-	Ground			RESERVED					PPS	O	PPS GPS		
76	GND	-	Ground			GPIO18	I/O	General Purpose Pin			GPIO18	I/O	General Purpose Pin		
77	GND	-	Ground			GND	-	Ground			GND	-	Ground		Power
78						RESERVED					RX_GPS_BIN	I	RX GPS SIRF BINARY data		CMOS 2.8V
79						RESERVED					GND	-	Ground		Power
80						RESERVED					TX GPS BIN	O	TX GPS SIRF BINARY data		CMOS 2.8V
81						RESERV					RESERV				-

	TRIZIUM					GE863-QUAD, GE863-PY					GE863-GPS				
Pin	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type	Signal	I/O	Function	Internal Pull UP	Type
						ED					ED				
82						RESERVED					GND	-			Power
83						RESERVED					GPS_ANT	I	RF hot for GPS radio 50 ohm		RF ANT
84						RESERVED					GND_GPS	-	GPS antenna ground		RF ANT

(1) For the exclusive use of the Technical Support Service
(3) On this pin a maximum of 47nF bypass capacitor is allowed.
(4) When activating the Easy camera these pins will not be available for other use

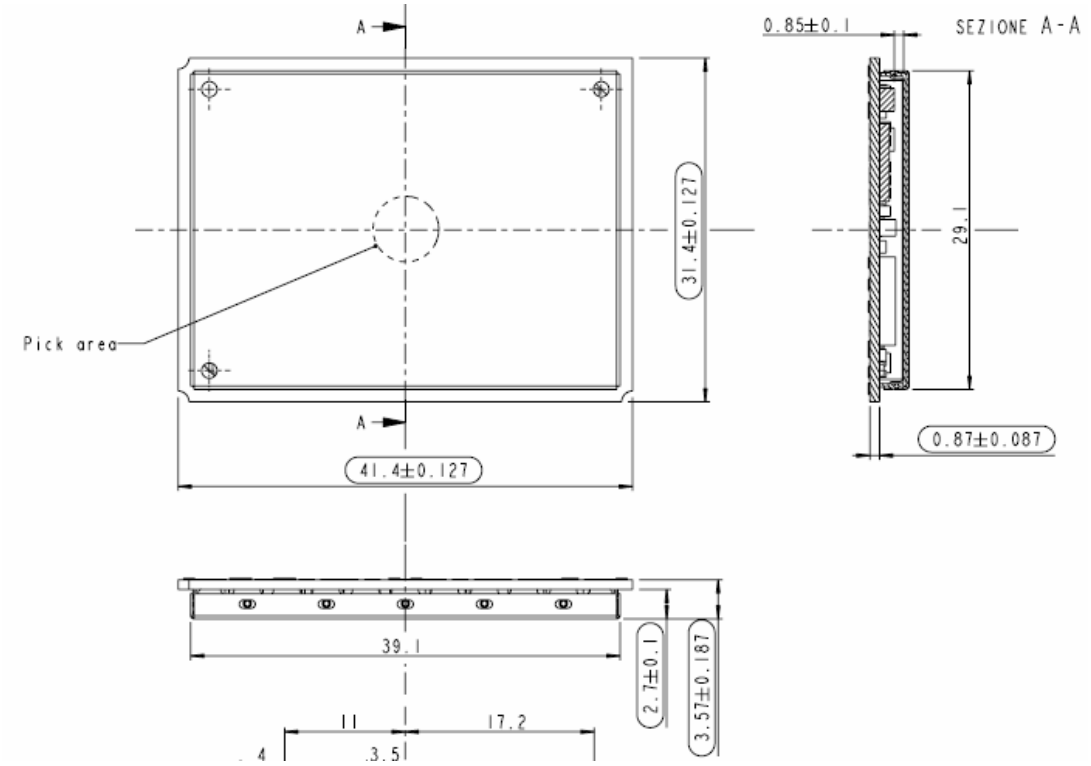
NOTE: RESERVED pins must not be connected

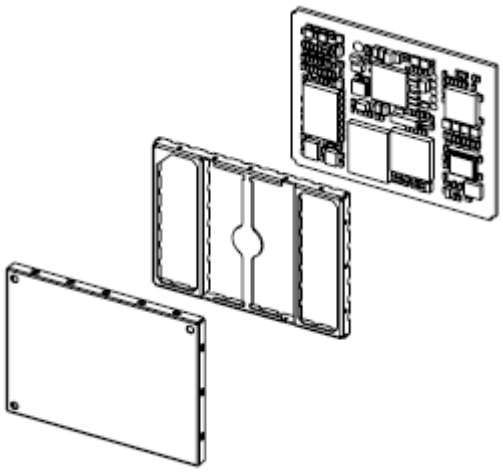
2.20 Mounting the GE863 on the Application Board

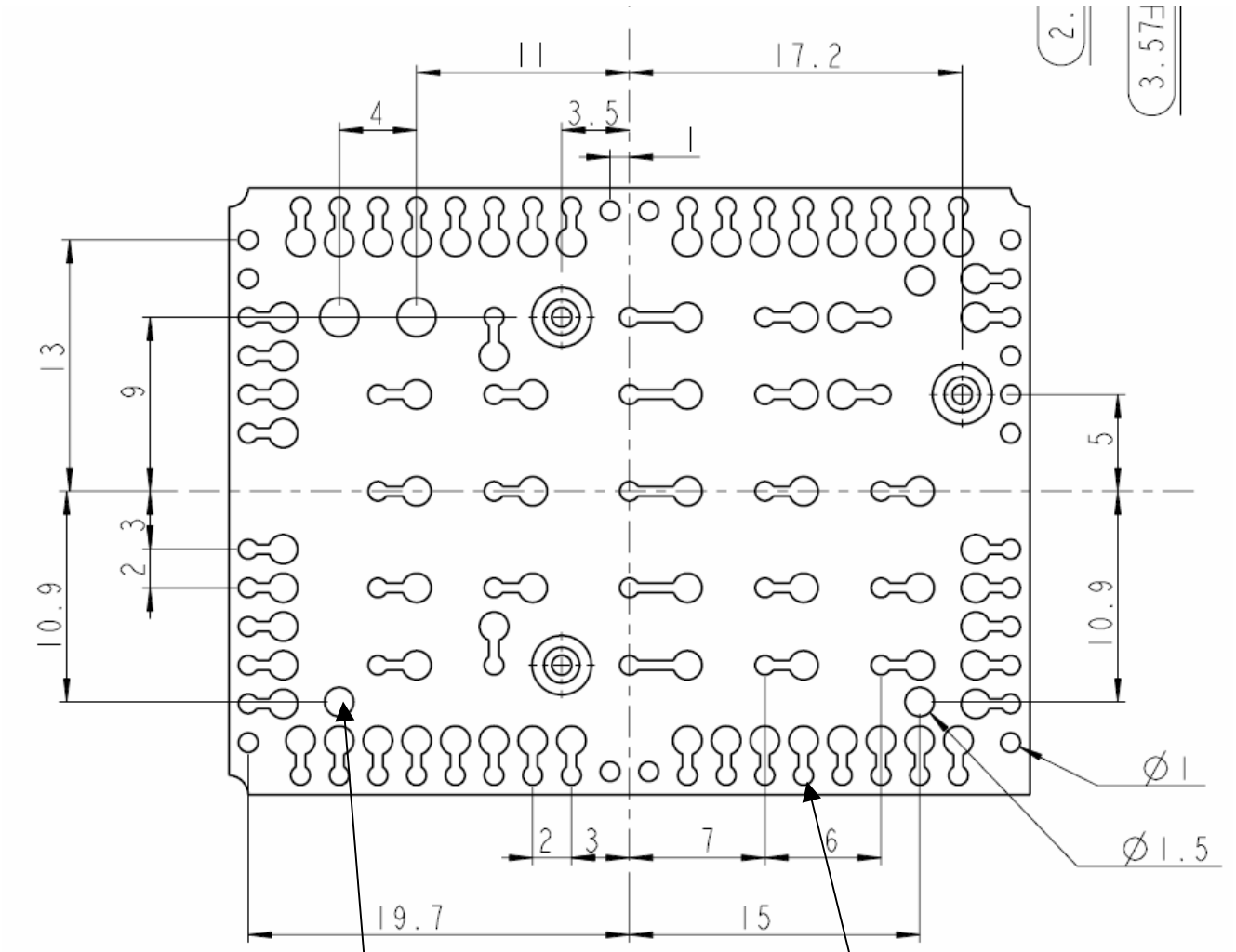
2.20.1 General

The TelitGE863 module has been designed in order to be compliant with a standard lead-free SMT process, with the following details.

2.20.2 Module finishing & dimensions



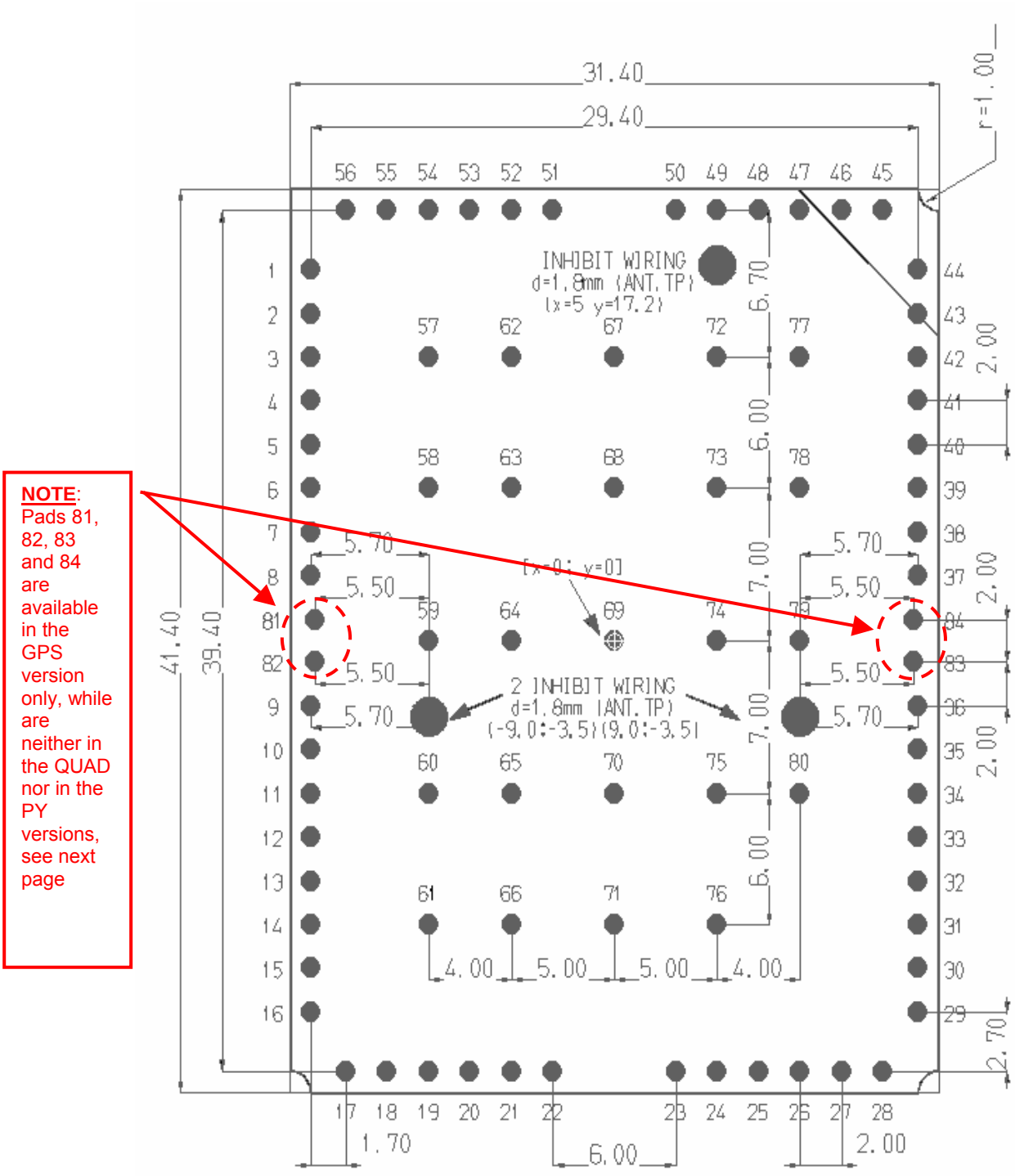




Surface finishing Ni/Au for all test pads

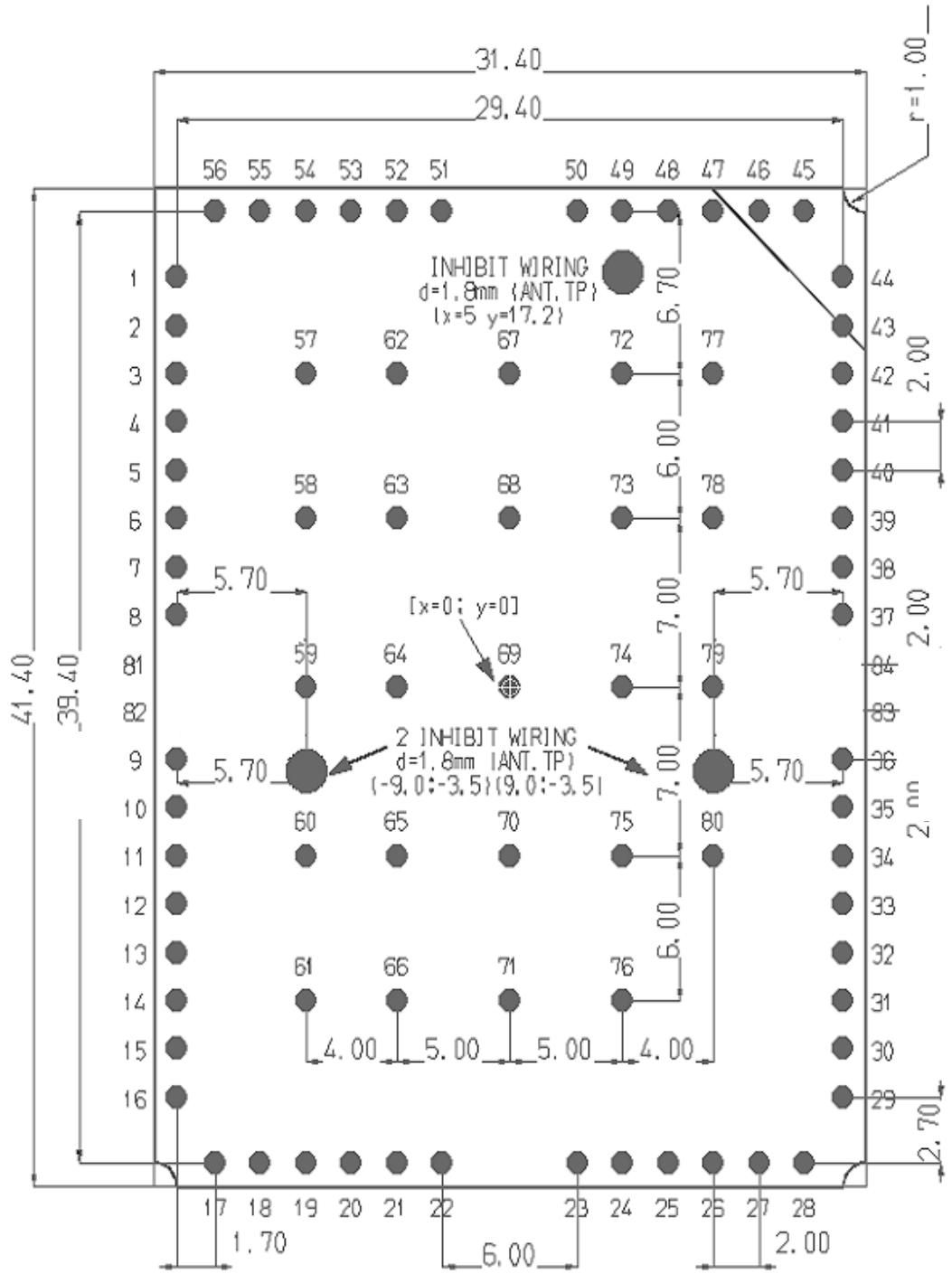
Lead-free Alloy
Surface finishing Sn/Ag/Cu for all solder pads

2.20.3 Recommended foot print for the application (GE863-GPS)



NOTE: Pads 81, 82, 83 and 84 are available in the GPS version only, while are neither in the QUAD nor in the PY versions, see next page

2.20.4 Recommended foot print for the application (GE863-PY, GE863-QUAD)



2.20.5 Debug of the GE863 in production

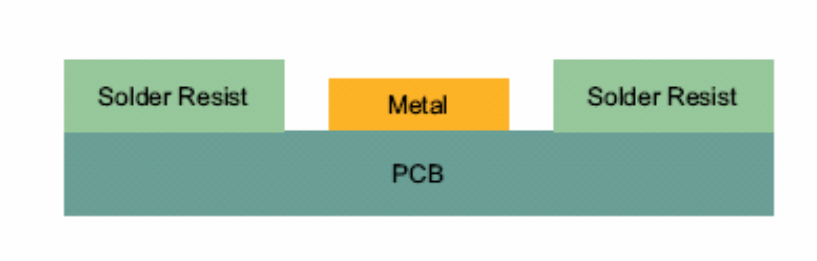
In order to test and debug the mounting of the GE863 in production, we strongly suggest to foreseen test pads on the host PCB, in order to check the connections between the GE863 itself and the application. Depending by the customer application, these test pads include, but are not limited to, the serial ports, the antenna, the audio lines and the GPIOs used by the application, just to mention few.

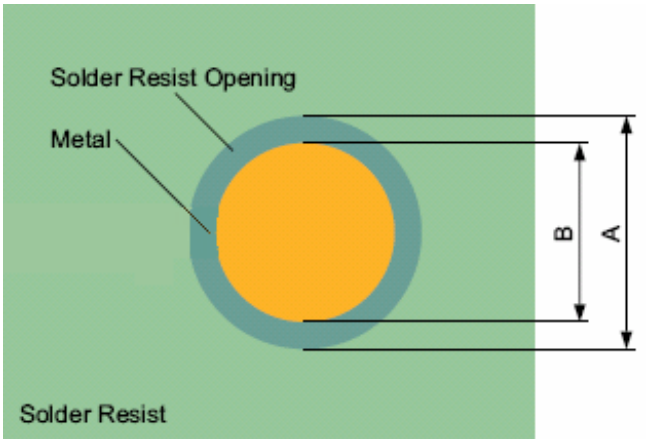
2.20.6 Stencil

Stencil's apertures layout can be the same of the recommended footprint (1:1), we suggest a thickness of stencil foil ≥ 120µm.

2.20.7 PCB pad design

"Non solder mask defined" (NSMD) type is recommended for the solder pads on the PCB.

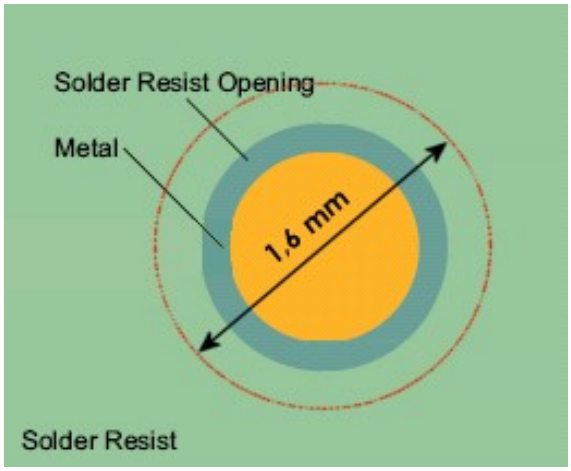




Recommendations for PCB pad dimensions

Ball pitch [mm]	2
Solder resist opening diameter A [mm]	1,150
Metal pad diameter B [mm]	1 ± 0.05

Placement of microvias not covered by solder resist is not recommended inside the "Solder resist opening", unless the microvia carry the same signal of the pad itself.



Holes in pad are allowed only for blind holes and not for through holes.

Recommendations for PCB pad surfaces:

Finish	Layer thickness [µm]	Properties
Electro-less Ni / Immersion Au	3 –7 / 0.05 – 0.15	good solder ability protection, high shear force values

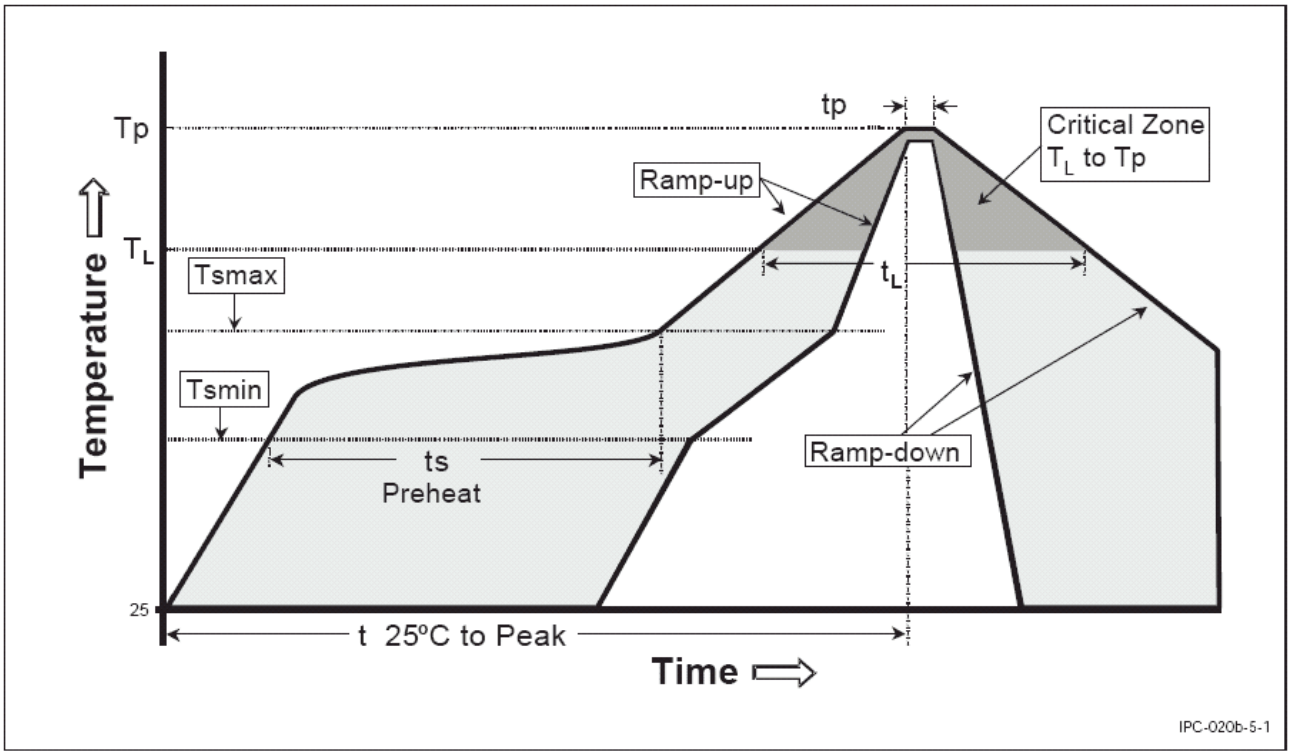
The PCB must be able to resist the higher temperatures, which are occurring at the lead-free process. This issue should be discussed with the PCB-supplier. Generally, the wet-ability of tin-lead solder paste on the described surface plating is better compared to lead-free solder paste.

2.20.8 Solder paste

	Lead free
Solder paste	Sn/Ag/Cu

2.20.9 GE863 Solder reflow

The following is the recommended solder reflow profile



Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max
Preheat: **– Temperature Min (Tsmin)** **– Temperature Max (Tsmax)** **– Time (min to max) (ts)**	 150°C 200°C 60-180 seconds
Tsmax to TL: **– Ramp-up Rate**	 3°C/second max
Time maintained above: **– Temperature (TL)** **– Time (tL)**	217°C 60-150 seconds
Peak Temperature (Tp):	245 +0/-5°C

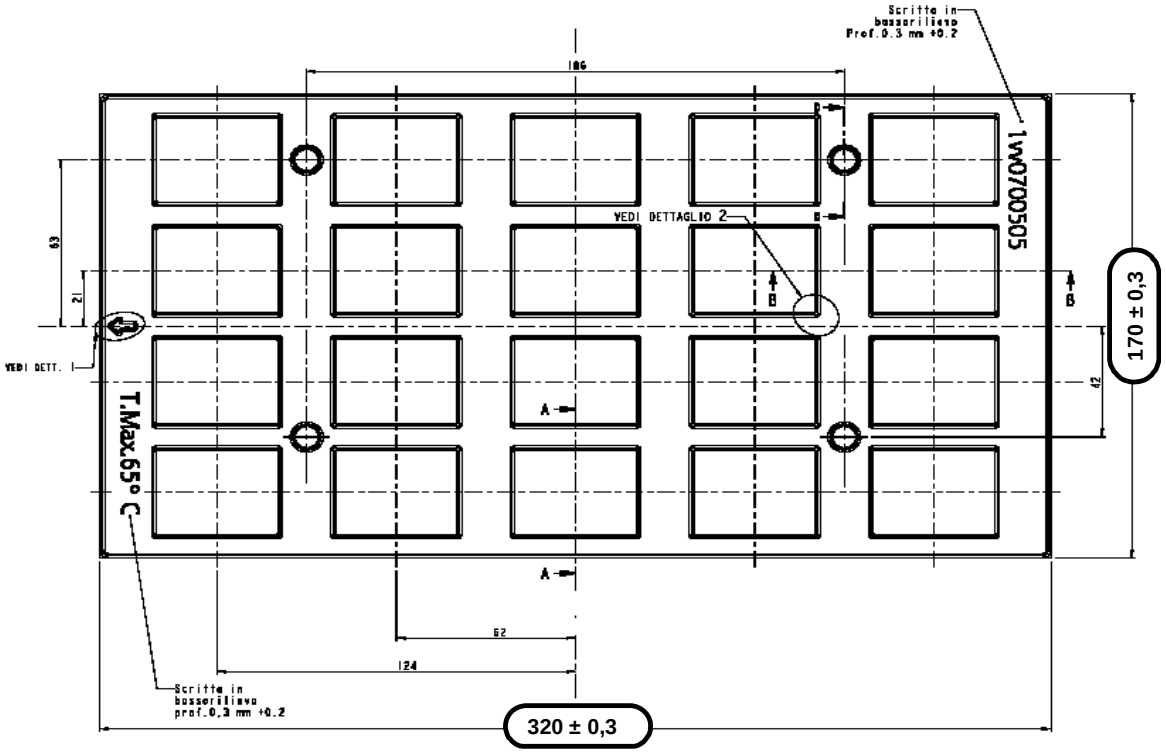
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

Note: GE863 module can accept only one reflow process

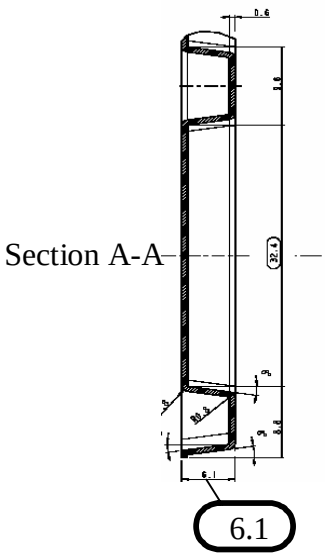
2.20.10 Packing system

According to SMT processes for pick & place movement requirements, Telit GE863 modules are packaged on trays, each tray contains 20 pieces. Tray dimensions are:

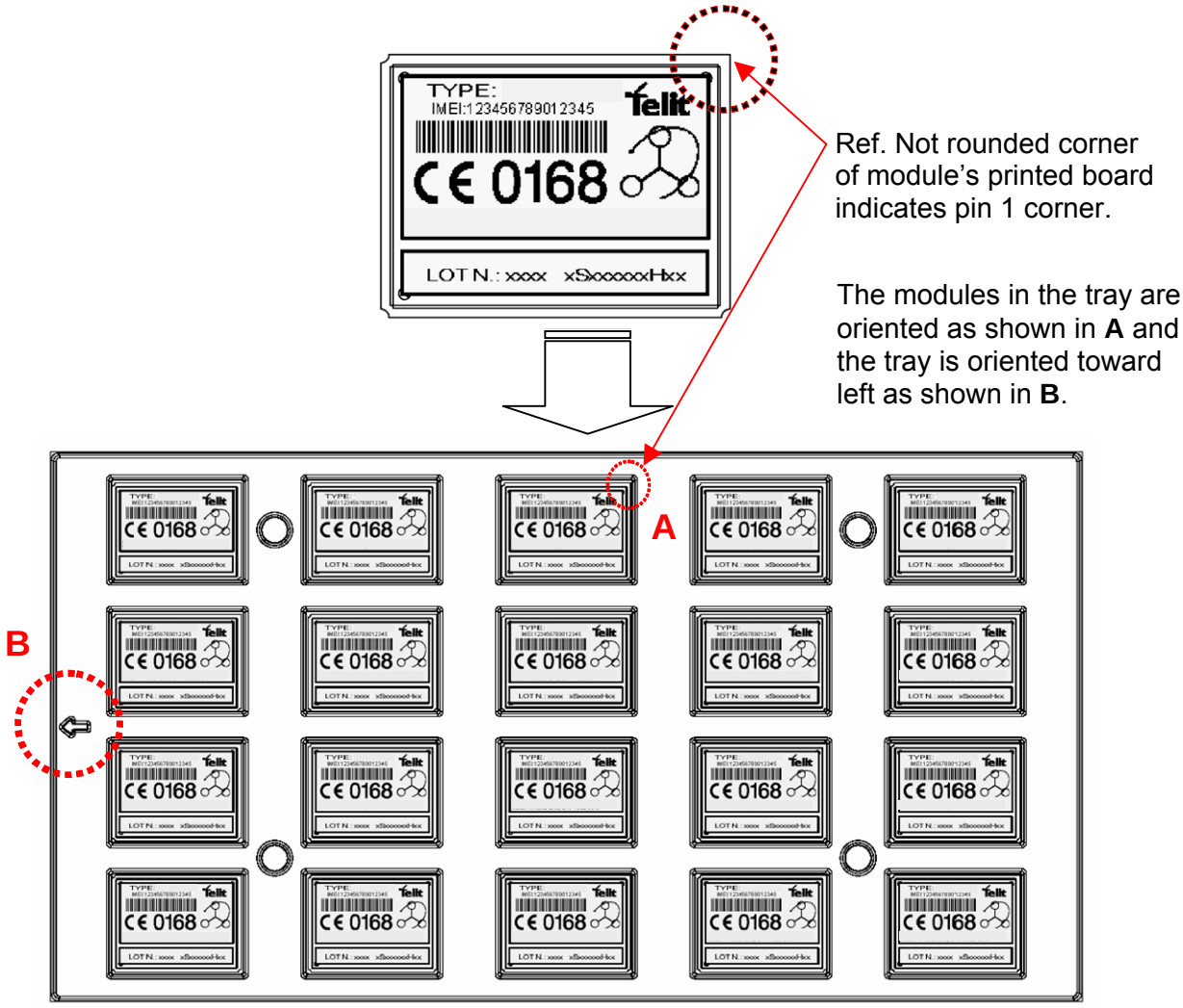


All quotes are in mm, general tolerance ± 0.1

Note that trays can withstand a maximum temperature of 65° C.



Modules orientation on tray:



2.20.11 Moisture sensibility

The level of moisture sensibility of Telit GE863 modules is “3”, according with standard IPC/JEDEC J-STD-020, take care of all the relative requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

a) The shelf life of GE863 inside of the dry bag shall be 12 month from the bag seal date, when stored in a non-condensing atmospheric environment of <40°C / 90% RH

b) Environmental condition during the production: ≤ 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5

c) The maximum time between the opening of the sealed bag and the reflow process shall be 168 hours if the condition b) “IPC/JEDEC J-STD-033A paragraph 5.2” is respected

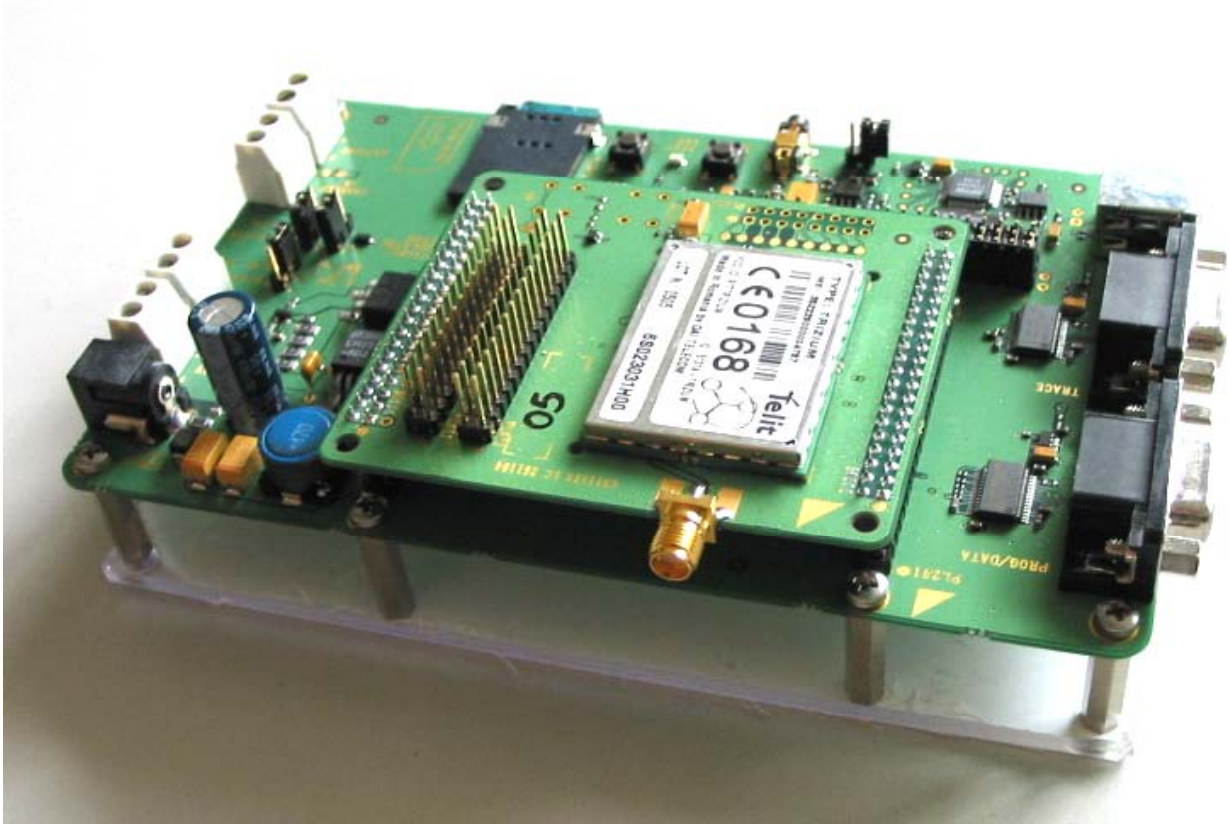
d) A baking is required if conditions b) or c) are not respected

e) A baking is required if the humidity indicator inside the bag indicates 10% RH or more

3 Evaluation Kit EVK2

In order to assist you in the development of your Telit GE863 module based application, Telit can supply an Evaluation Kit EVK2 with appropriate power supply, SIM card holder, RS232 serial port level translator and USB, audio and antenna connection.
The standard serial RS232 9 pin or USB connector placed on the Evaluation Kit allows the connection of the EVK system with a PC or other DTE.
The development of the applications utilizing the Telit GE863 module must present a proper design of all the interfaces towards and from the module (e.g. power supply, audio paths, level translators), otherwise a decrease in the performances will be introduced or, in the worst case, a wrong design can even lead to an operating failure of the module.

In order to assist the hardware designer in his project phase, the EVK board presents a series of different solutions, which will cover the most common design requirements on the market, and which can be easily integrated in the OEM design as building blocks or can be taken as starting points to develop a specific one.



EVK2 Evaluation Kit (PRELIMINARY)

3.1 Evaluation Kit description

For a detailed description of the Telit Evaluation Kit refer to the documentation provided with the board.

3.1.1 Power Supply

On the Board there are three different power sources, which embrace a wide range of applications, from the automotive +12V / +24V input to the stand alone battery powered device.

The power sources nominal input voltages are:

- +5 - +40V input
- +3.8V direct input for stabilized laboratory power supply
- direct Li-Ion Battery power input (also with charging function of the module, when a suitable charger is connected to the charger input

Each one of these power sources can supply both the Telit GE863 modules and the whole circuitry embodied in the Evaluation Kit.
Only one of these power sources can be used at a time and it is selectable with two jumpers.

3.1.2 Serial interface

The communications between your application and the Telit GE863 modules must be done through a serial interface, which can be a standard, CMOS UART or a RS232 port.
All levels of the RS232 port are conforming to RS232 and V.24 standard and a PC serial port can be directly connected to this connector.
Both these interfaces are supported.

3.1.3 Audio

The Evaluation Kit board provides two selectable audio paths. See the reference documentation for more details.

3.1.4 GPIO and LEDs

All the General Purpose Input Output ports of the Telit GE863 modules are supported in a dedicated connector.

4 Service and firmware update

The Telit GE863 modules firmware can be updated through the same serial interface, which is used normally for the AT commands. Since the software group is continuously working, in order to improve the overall performances and introduce new features on the product, we suggest, in order to keep updated the module's firmware, to foreseen an external access to that interface with level converters to RS232, which allows connecting a Windows-based PC, since it is normally not possible to disconnect a GE863 module already soldered on the PCB of the application. It shall be possible to start the update procedure at POWER OFF condition of the module and then switch it ON to continue.

During the application development or evaluation phase of the GE863 module, the RS232 interface with the level converters or the USB port implemented on the **Telit Evaluation Kit EVK2** can be used to connect to a Windows-based PC on which the specific program for updating the Software (TFI) can be run.

4.1 Step-by-Step upgrade procedure

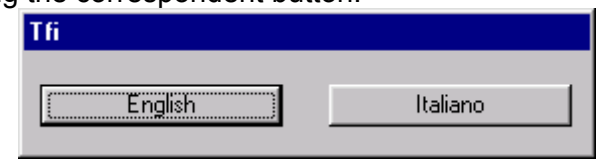
The firmware update can be done with a specific software tool provided by Telit that runs on Windows based PCs.

First the program will erase the content of flash memory, then the program will write on the flash memory. To update the firmware of the module, we suggest the following procedure:

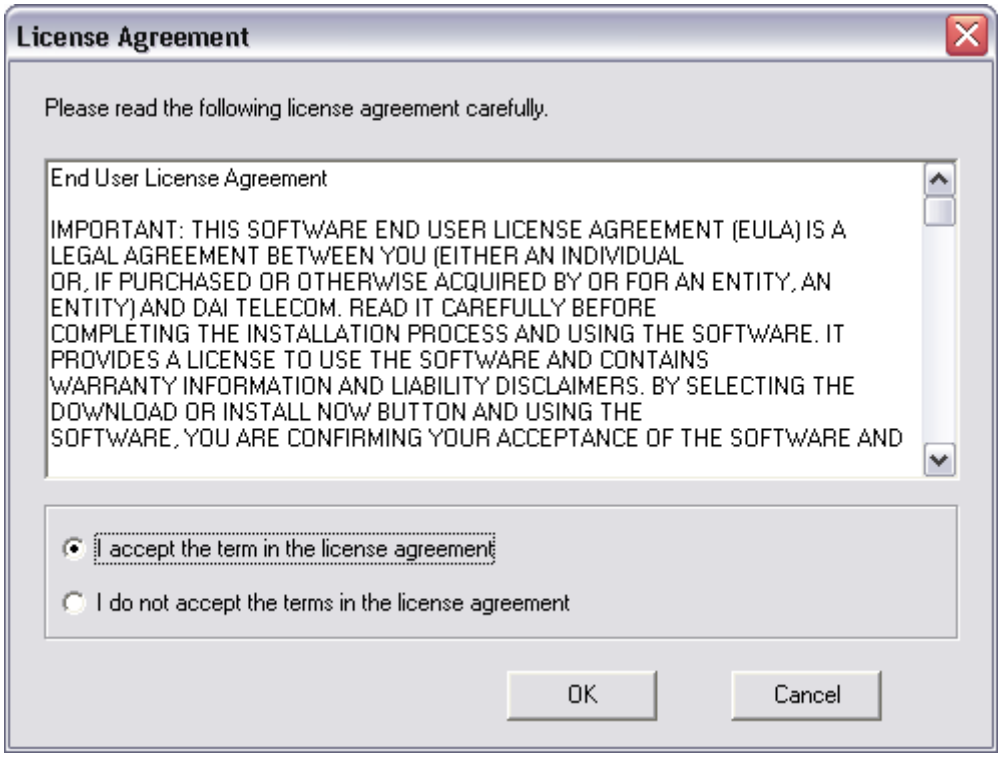
I. Collect information about the Hardware and implemented version of Software by the command
   - AT+CGMR<enter>, which returns the Software version information;
   - AT+CGMM<enter>, which returns the Model Identification.

II. Switch OFF the module.

III. Run the file *TFI_xxxx.exe*. The following window should be displayed, Select the language preferred by pressing the correspondent button.



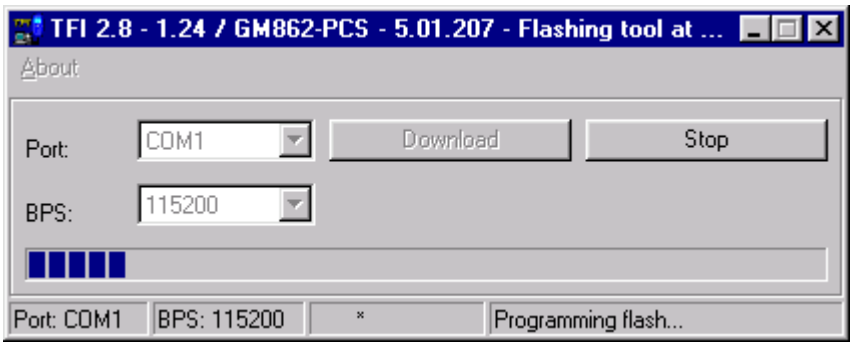
IV. The End User License Agreement will appear. Please, read it and accept the terms if you are going to proceed.



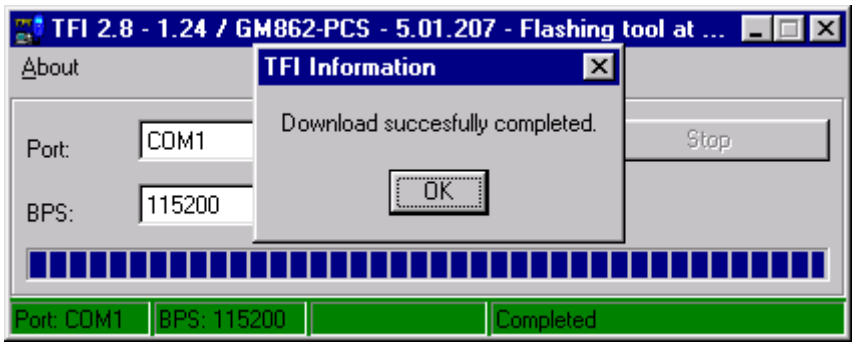
V. Press OK to the initial message.

NOTE: In connection with the GE863 modules, charged battery has to be understood that the power supply must not be disconnected during the firmware update.

VI. Select the right COM port and speed. Note that to go faster than 115200 you need a special hardware on the PC. Then Press the Download button and within 5 seconds power-on the GE863.



Wait for the end of programming green message OK



The **Telit GE863 module** is now programmed with the new firmware.

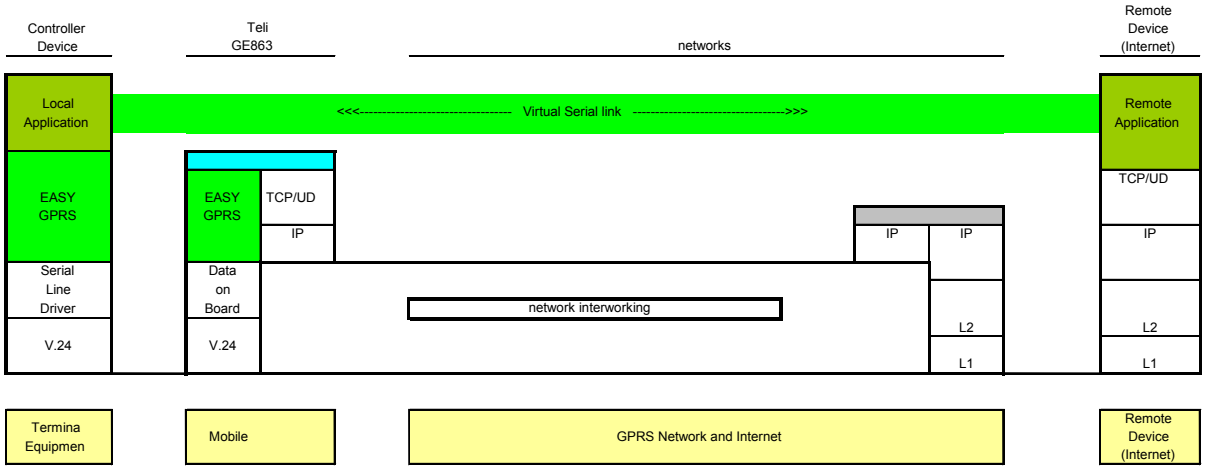
NOTE: the above pictures show how the application dialogs appear for the GM862 product. The GE863 TFI application will look similar.

5 Software Features

5.1 Enhanced Easy GPRS Extension

5.1.1 Overview

The Easy GPRS feature allows a Telit GE863 modules user to contact a device in Internet and establish with it a raw data flow over the GPRS and Internet networks.
This feature can be seen as a way to obtain a “virtual” serial connection between the Application Software on the Internet machine involved and the controller of the Telit GE863 modules, regardless of all the software stacks underlying.
An example of the protocol stack involved in the devices is reported:



This particular implementation allows to the devices interfacing to the Telit GE863 modules the use of the GPRS and Internet packet service without the need to have an internal TCP/IP stack since this function is embedded inside the module.

The new **Enhanced version** of the Easy GPRS overcomes some of the known limitations of the previous implementation and implements some new features such as:

Keep the GPRS context active even after the closing of a socket, allowing the application to keep the same IP address;
Also Mobile terminated (incoming) connections can be made, now it is possible to receive incoming TCP connection requests;
A new internal firewall has been implemented in order to guarantee a certain level of security on internet applications.

5.1.2 Easy GPRS definition

The Easy GPRS feature provides a way to replace the need of an Internet TCP/IP stack at the terminal equipment side. The steps that will be required to obtain a virtual serial connection (that is actually a socket) to the Internet peer are:

- Configuring the GPRS Access
- Configuring the embedded TCP/IP stack behavior
- Defining the Internet Peer to be contacted
- Request the GPRS and socket connections to be opened (host is connected)
- Exchange raw data
- Close the socket and GPRS context

All these steps are achieved through AT commands.

As for common modem interface, two logical statuses are involved: command mode and data traffic mode:

- In Command Mode (CM), some AT commands are provided to configure the Data Module Internet stack and to start up the data traffic.
- In data traffic mode (Socket Mode, SKTM), the client can send/receive a raw data stream which will be encapsulated in the previously configured TCP / IP packets which will be sent to the other side of the network and vice versa. Control plane of ongoing socket connection is deployed internally to the module.

5.1.2.1 Configuring the GPRS access

The GPRS access configuration is done by setting the following:

- The GPRS context number 1 parameters (see +CGDCONT command)
- The Authentication parameters: User Name and Password (see commands #USERID, #PASSW)

5.1.2.2 Configuring the embedded TCP/IP stack

The TCP/IP stack behavior must be configured by setting:

- The packetizer default packet size (see command #PKTSZ)
- The data sending timeout (see command #DSTO)
- The socket inactivity timeout (see command #SKTTO)

5.1.2.3 Defining the Internet peer to be contacted

As last setting definition, the host to be contacted and on which port/protocol must be set the socket definition (see command #SKTSET).
This command permits also to specify the host name instead of its IP address, if a host name is given to the set command, then the module stores it as a host nick name. It is care of the module user to guarantee that the host nick name provided corresponds to an existing internet peer.
If a host nick name has been given then, while opening the connection in response to the AT#SKTOP command, the module will autonomously activate a GPRS connection and query its DNS to obtain the IP address relative to the host nick name provided. This process of context activation and DNS query may require a bit more time and requires that the GPRS network coverage is good enough to permit data transfers.

5.1.2.4 Open the connection with the internet host

With the AT#SKTOP all the process required to connect with the internet host starts:

- GE863 activates the first context
- GE863 proceeds to the authentication with the parameters specified on par.5.1.2.1 and par. 5.1.2.2

Eventually does the DNS query to resolve the IP address of the host name internet peer
GE863 establishes a TCP/UDP (depending on the parameter request) connection with the given internet host. Once the connection is up the module reports the code: CONNECT

From this moment the data incoming in the serial port is packet and sent to the Internet host, while the data received from the host is serialized and flushed to the Terminal Equipment.

5.1.2.5 Close the Socket and deactivate the context

The connection can be closed because of:

- Remote host TCP connection close
- Socket inactivity timeout

Terminal Equipment by issuing the escape sequence “+++”
Network deactivation

Note: if in the raw data to be sent there’s an escape sequence, then the TE must work it out and sent it in a different fashion to guarantee that the connection is not closed.
The pause time is defined in the parameter S12.
On the reception of an escape sequence the GE863 closes the connection, deactivates the GPRS context returning to command mode and issuing the NO CARRIER code.

5.1.3 Enhanced Easy GPRS Outgoing connection

The New Enhanced Easy GPRS feature provides a way to place outgoing TCP/UDP connections and keep the same IP address after a connection, leaving the GPRS context active.
The steps that will be required open a socket and close it without closing the GRPS context are:

- Configuring the GPRS Access
- Configuring the embedded TCP/IP stack behavior
- Defining the Internet Peer to be contacted
- Request the GPRS context to be activated
- Request the socket connection to be opened
- Exchange data
- Close the TCP connection while keeping the GPRS active

All these steps are achieved through AT commands.
As for common modem interface, two logical statuses are involved: command mode and data traffic mode.
In Command Mode (CM), some AT commands are provided to configure the Data Module Internet stack and to start up the data traffic.

In data traffic mode (Socket Mode, SKTM), the client can send/receive a raw data stream which will be encapsulated in the previously configured TCP / IP packets which will be sent to the other side of the network and vice versa. Control plane of ongoing socket connection is deployed internally to the module.

5.1.3.1 Configuring the GPRS access

The GPRS access configuration is done by setting:

- The GPRS context number 1 parameters (see +CGDCONT command)
- The Authentication parameters: User Name and Password (see commands #USERID, #PASSW)

5.1.3.2 Configuring the embedded TCP/IP stack

The TCP/IP stack behavior must be configured by setting:

- The packetizer default packet size (see command #PKTSZ)
- The data sending timeout (see command #DSTO)
- The socket inactivity timeout (see command #SKTTO)

5.1.3.3 Defining the Internet peer to be contacted

As last setting definition, the host to be contacted and on which port/protocol must be set the socket definition (see command #SKTSET).
This command permits also to specify the host name instead of its IP address, if a host name is given to the set command, then the module stores it as a host nick name. It is care of the module user to guarantee that the host nick name provided corresponds to an existing internet peer.
If a host nick name has been given then, while opening the connection in response to the AT#SKTOP command, the module will autonomously activate a GPRS connection and query its DNS to obtain the IP address relative to the host nick name provided. This process of context activation and DNS query may require a bit more time and requires that the GPRS network coverage is good enough to permit data transfers.
Note that this setting command is not needed if the new #SKTD command is used.

5.1.3.4 Request the GPRS context to be activated

With the new command #GPRS you can activate or deactivate a GPRS context INDEPENDENTLY from the TCP socket opening:

AT#GPRS=1 activates the context,
AT#GPRS=0 deactivates the context

Therefore with the AT#GPRS=1 command the module does the following:

- GE863 activates the context previously defined with AT+CGDCONT
- GE863 proceeds to the authentication with the parameters specified par. 5.1.2.1 and par. 5.1.2.2.

Note that activating a context implies getting an IP address from the network and this will be maintained throughout the session.
The response code to the AT#GPRS=1 command reports the IP address obtained from the network, allowing the user to report it to his server or application.

Deactivating the context implies freeing the network resources previously allocated to the device.

5.1.3.5 Open the connection with the internet host

With the new command #SKTD (socket Dial) the TCP/UDP request to connect with the internet host starts:
Eventually does the DNS query to resolve the IP address of the host name internet peer, the GE863 establishes a TCP/UDP (depending on the parameter request) connection with the given internet host.
Once the connection is up the module reports the code: CONNECT
Note that the peer specifications of this socket Dial are within the command and not the one stored with #SKTSET command.
From this moment the data incoming in the serial port is packet and sent to the Internet host, while the data received from the host is serialized and flushed to the Terminal Equipment.

NOTE: this command differently from the AT#SKTOP DOES NOT automate all the process of activating the GPRS, if no GPRS is active the command reports ERROR; therefore before issuing this command the GPRS shall be activated with AT#GPRS=1 command.
In the same manner, when disconnecting the #SKTD command does not close the GPRS context, leaving it active for next connections until an AT#GPRS=0 command is issued or the network requests a context closing.

5.1.3.6 Close the Socket without deactivating the context

The connection can be closed because of:

- Remote host TCP connection close
- Socket inactivity timeout
- Terminal Equipment by issuing the escape sequence “+++”
- Network deactivation

Note: if in the raw data to be sent there’s an escape sequence, then the TE must work it out and sent it in a different fashion to guarantee that the connection is not closed.
The pause time is defined in the parameter S12.
On the reception of an escape sequence if the socket was opened with the AT#SKTD command, the GE863 closes the connection, does not deactivate the GPRS context and returns to command mode issuing the NO CARRIER code.

5.1.4 Enhanced Easy GPRS Incoming Connection

The New Enhanced Easy GPRS feature provides a way to accept incoming TCP/UDP connections and keep the same IP address after a connection, leaving the GPRS context active.
The steps that will be required to open a socket in listen, waiting for connection requests from remote hosts and accept these request connections only from a selected set of hosts, then close it without closing the GRPS context are:

- Configuring the GPRS Access
- Configuring the embedded TCP/IP stack behavior (see par. 5.1.3.2)
- Defining the Internet Peer that can contact this device (firewall settings) (see par. 5.1.4.1)
- Request the GPRS context to be activated (see par. 5.1.3.4)
- Request the socket connection to be opened in listen (see par. 5.1.4.2)

- Receive connection requests (see par. 5.1.4.3)
- Exchange data
- Close the TCP connection while keeping the GPRS active (see par. 5.1.3.6)

All these steps are achieved through AT commands.
As for common modem interface, two logical statuses are involved: command mode and data traffic mode.
In Command Mode (CM), some AT commands are provided to configure the Data Module Internet stack and to start up the data traffic.
In data traffic mode (Socket Mode, SKTM), the client can send/receive a raw data stream which will be encapsulated in the previously configured TCP / IP packets which will be sent to the other side of the network and vice versa. Control plane of ongoing socket connection is deployed internally to the module.

5.1.4.1 Defining the Internet Peer that can contact this device (firewall settings)

The Telit GE863 modules have an internal Firewall that controls the behavior of the incoming connections to the module.
The firewall applies for INCOMING (listening) connections; OUTGOING connections will be always done regardless of the firewall settings.
Firewall General Policy is DROP, therefore all packets that are not included into an ACCEPT chain rule will be silently discarded.

When packet incomes from the IP address <incoming IP>, the firewall chain rules will be scanned for matching with the following criteria:

<incoming IP> & <net mask> = <ip_address> ?

if the result is yes, then the packet is accepted and the rule scan is finished, otherwise the next chain is taken into account until the end of the rules when the packet is silently dropped if no matching was found.

For example, let assume we want to accept connections only from our devices which are on the IP addresses ranging from 197.158.1.1 to 255.255.0.0

We need to add the following chain to the firewall:

AT#FRWL=1,”197.158.1.1”,”255.255.0.0”

5.1.4.2 Request the socket connection to be opened in listen

With the new command #SKTL (socket Listen) the TCP request to start listening for connection requests is executed:
GE863 opens a listening socket on the port specified, waiting for incoming TCP connections (depending on the parameter request) with the internet hosts.

The parameters that shall be specified are the local port where packets shall be received, the type of socket and the closing behavior.

5.1.4.3 Receiving connection requests

Once the connection request is received, the module reports an indication of connection with an unsolicited code

+CONN FROM: <remote address>

Then connection is accepted and once it is up the module reports the code:
CONNECT

From this moment the data incoming in the serial port is packet and sent to the Internet host, while the data received from the host is serialized and flushed to the Terminal Equipment.
Note that the connections request are FIRST screened in the firewall, then if they are accepted they pass to the listening socket; therefore only hosts that are in the ACCEPT chain rules of the firewall can induce a connection request, the other host requests will be silently discarded without any indication to the remote host (for security reasons).
Once the connection is received and closed, the socket is not anymore in listen. If the application needs again to be in listen, then it shall send again the socket listen #SKTL command.

NOTE: this command differently from the AT#SKTOP DOES NOT automate all the process of activating the GPRS, if no GPRS is active the command reports ERROR; therefore before issuing this command the GPRS shall be activated with AT#GPRS=1 command.
In the same manner, when disconnecting the #SKTL command does not close the GPRS context, leaving it active for next connections until an AT#GPRS=0 command is issued or the network requests a context closing.

5.1.5 Known limitations

The implementation of the EASY GPRS feature has the following known limitations:

- Only one socket can be opened at a time, no multiple socket connections can be made;
- Only one connection request can be accepted at a time, subsequent requests will be silently discarded.
- Only the first GPRS context is associated with this feature;

It is taken for granted that external processor will be able to handle at least a limited v.24 implementation: RTS, CTS and, highly recommended, DCD lines; this because software flow control is not applicable to the feature;
Due to the particularity of this feature, the flow control of both the directions uplink and downlink is interlocked

5.2 Jammed Detect & Report Extension

5.2.1 Overview

The Jammed Detect & Report feature allows a Telit GE863 module to detect the presence of a disturbing device such as a Communication Jammer and give indication to the user and/or send a report of that to the network.

This feature can be very important in alarm, security and safety applications that rely on the module for the communications. In these applications, the presence of a Jammer device can compromise the whole system reliability and functionality and therefore shall be recognized and reported either to the local system for countermeasure actions or to the network providing remote actions.
An example scenario could be an intrusion detection system that uses the module for sending the alarm indication for example with an SMS to the system owner, and thief incomes using a Jammer to prevent any communication between the GSM module and the network.

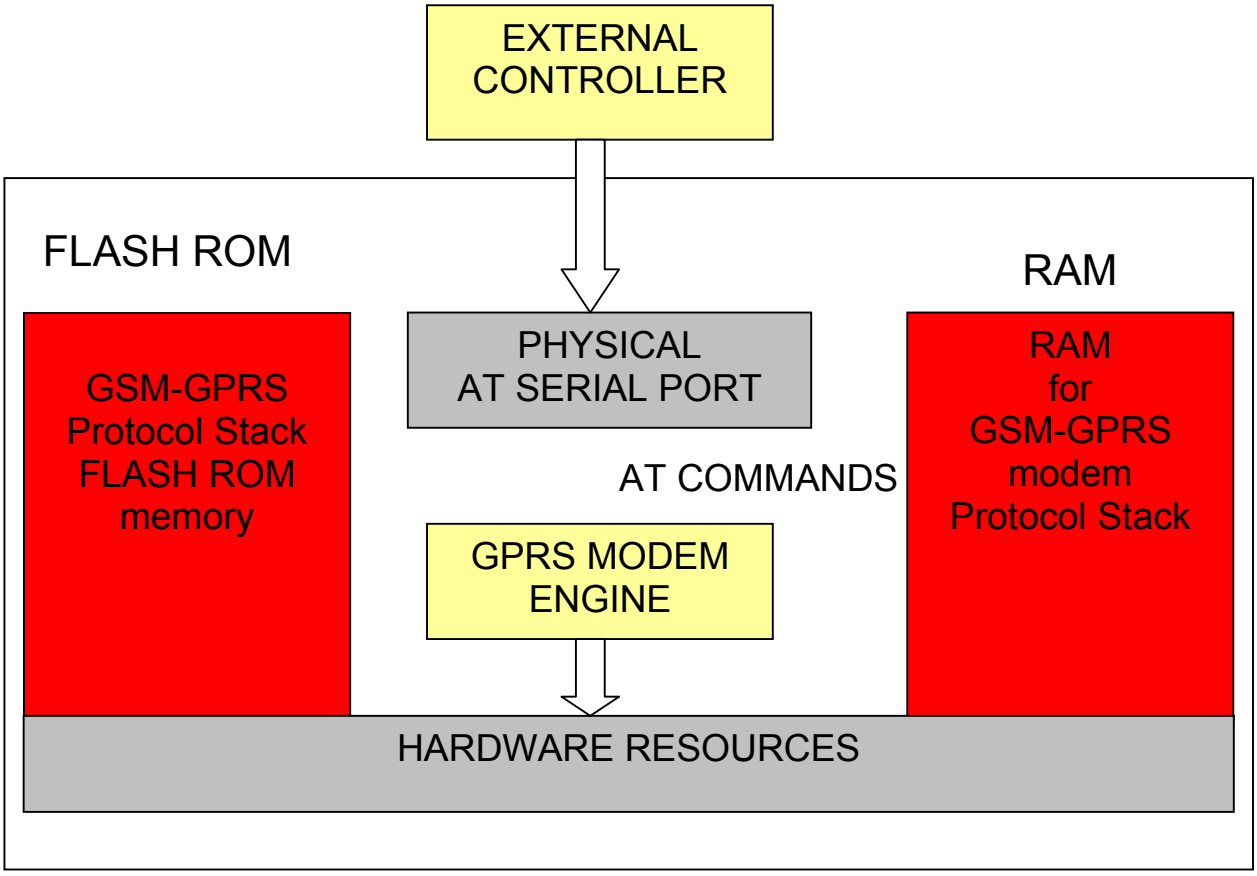
In such a case, the module detects the Jammer presence even before the break in and can trigger an alarm siren, other communication devices (PSTN modem) or directly report this condition to the network that can provide further security services for example sending SMS to the owner or police. Obviously this last service depends also from network infrastructure support and it may not be supported by some networks.

5.3 Easy Script Extension - Python interpreter

5.3.1 Overview

This feature is available only on the **Telit GE863-PY AND GE863-GPS.**

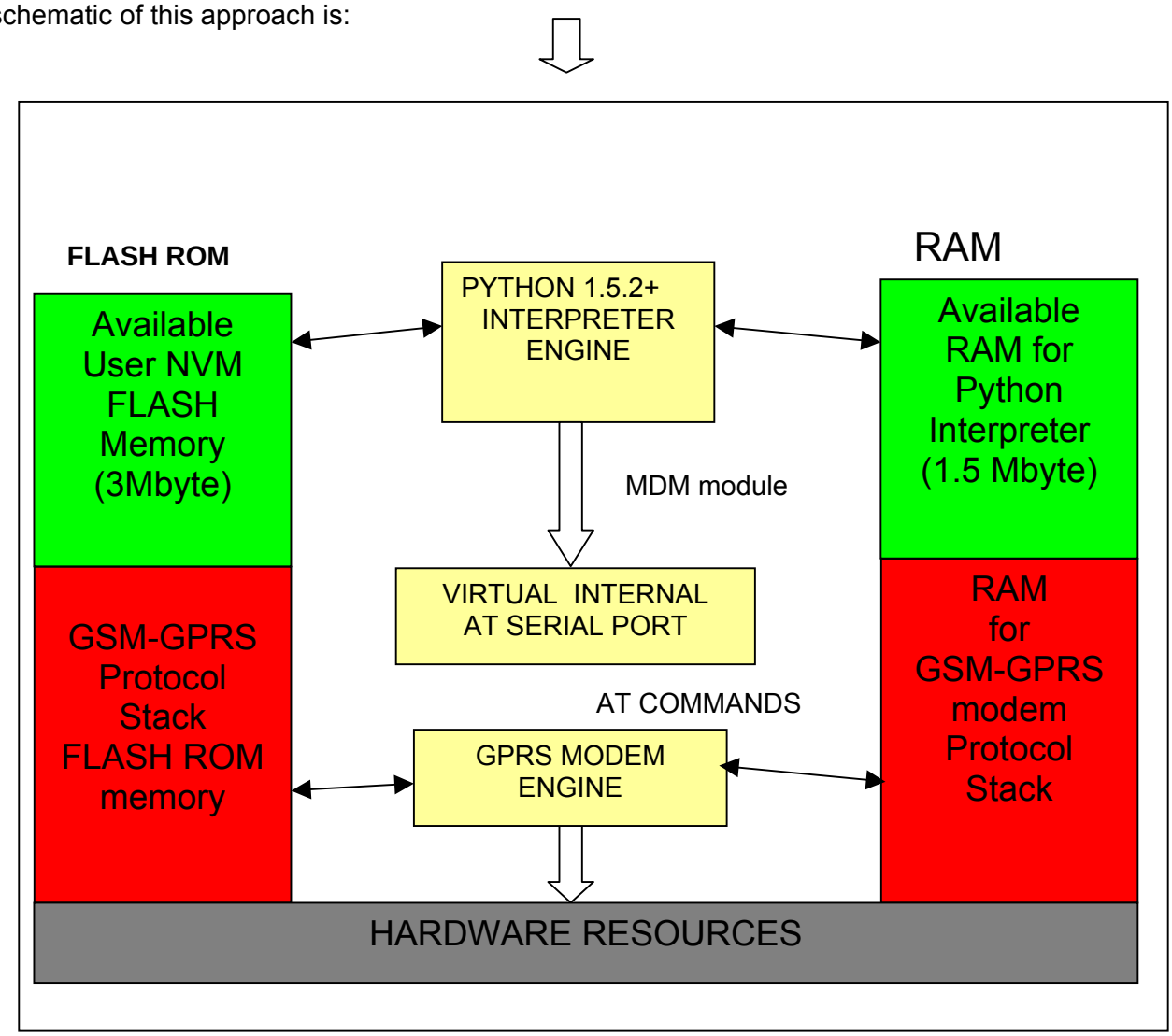
The Easy Script Extension is a feature that allows driving the modem "internally" writing the controlling application directly in a nice high level language: Python.
The Easy Script Extension is aimed at low complexity applications where the application was usually done by a small microcontroller that managed some I/O pins and the module through the AT command interface.
A schematic of such a configuration can be:



In order to eliminate this external controller, and further simplify the programming of the sequence of operations, inside the Python version it is included:

- ***Python script interpreter engine v. 1.5.2+***
- ***around 3MB of Non Volatile Memory room for the user scripts and data***
- ***1.5 MB RAM reserved for Python engine usage***

A schematic of this approach is:



5.3.2 Python 1.5.2+ Copyright Notice

The Python code implemented into the module is copyrighted by Stichting Mathematisch Centrum, this is the license:

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While CWI is the initial source for this software, a modified version is made available by the Corporation for National Research Initiatives (CNRI) at the Internet address ftp://ftp.python.org.

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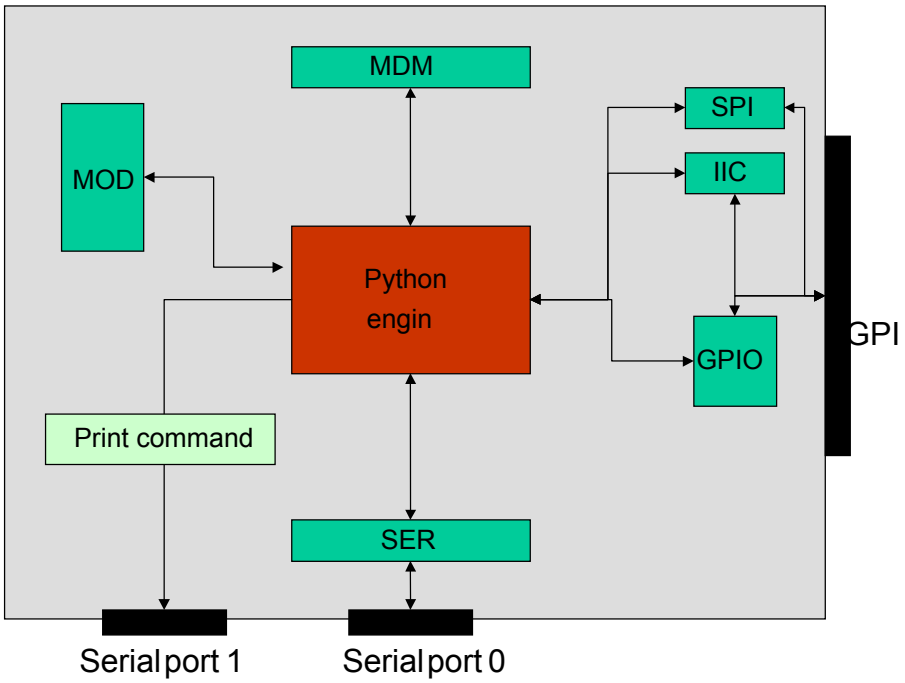
5.3.3 Python implementation description

Python scripts are text files, it is possible to run one Python script in the **Telit** module.
The Python script is stored in NVM inside the Telit module, there's a file system inside the module that allows to write and read files with different names on one single level (no subdirectories are supported).
The Python script is executed in a task inside the Telit module at the lowest priority, making sure this does not interfere with GPRS/GSM normal operations. This allows serial ports, protocol stack etc. to run independently from the Python script.
The Python script interacts with the Telit module functionality through four build-in interfaces.



The MDM interface is the most important one. It allows Python script to send AT commands, receive responses and unsolicited indications, send data to the network and receive data from the network during connections.
It is quite the same as the usual serial port interface in the Telit MODULE. The difference is that this interface is not a real serial port but just an internal software bridge between Python and mobile internal AT command handling engine.
All AT commands working in the Telit MODULE are working in this software interface as well. Some of them have no meaning on this interface, such as those regarding serial port settings.
The usual concept of flow control keeps its meaning over this interface, but it's managed internally.

The SER interface allows Python script to read from and write to the REAL, physical serial port where usually the AT command interface resides, for example to read NMEA information from a GPS device. When Python is running this serial port is free to be used by Python script because it is not used as AT command interface since the AT parser is mapped into the internal virtual serial port. No flow control is available from Python on this port.
The GPIO interface allows Python script to handle general purpose input output faster than through AT commands, skipping the command parser and going directly to control the pins.
The MOD interface is a collection of useful functions.
For the debug, the print command is directly forwarded on the EMMI TX pin (second serial port) at 9600 baud 8N1.

5.3.4 Python core supported features

The Python core version is 1.5.2+ (string methods added to 1.5.2).
You can use all Python statements and almost all Python built-in types and functions.
The following are not supported:
complex; float; long; docstring.

Available modules are:

marshal, imp, __main__, __builtin__, sys
md5

All the others are not supported.

5.3.5 Python Build-in Custom Modules

Several build in custom modules have been included in the python core, specifically aimed at the hardware environment of the module.
The build in modules included are:

MDM: interface between Python and mobile internal AT command handling;
SER: interface between Python and mobile internal serial port ASC0 direct handling;
GPIO: interface between Python and mobile internal general purpose input output direct handling;
MOD: interface between Python and mobile miscellaneous functions.
IIC: custom software Inter IC bus that can be mapped on creation over almost any GPIO pin available.
SPI: custom software Serial Protocol Interface bus that can be mapped on creation over almost any GPIO pin available.

More details about the Python modules are available in the reference guide.

6 AT Commands

The Telit GE863 modules can be driven via the serial interface using the standard AT commands[1].

The Telit GE863 modules are compliant with:

- Hayes standard AT command set, in order to maintain the compatibility with existing SW programs.
- ETSI GSM 07.07 specific AT command and GPRS specific commands.
- ETSI GSM 07.05 specific AT commands for SMS (Short Message Service) and CBS (Cell Broadcast Service)
- FAX Class 1 compatible commands

Moreover the Telit GE863 modules support also Telit proprietary AT commands for special purposes.

The following table lists all supported AT commands and related brief description.

Hayes Compliant AT Commands		AT Commands availability for GE863 , models:			
Generic Modem Control		**QUAD**	**PY**	**GPS**	
&F	Reset base section factory profile configuration	•	•	•	
&F1	Reset full factory profile configuration	•	•	•	
Z	Soft reset	•	•	•	
+FCLASS	Select active service class	•	•	•	
&Y	Designate a default reset basic profile	•	•	•	
&P	Designate a default reset full profile	•	•	•	
&W	Store current configuration	•	•	•	
&Z	Store telephone number in the internal phonebook	•	•	•	
&N	Display internal phonebook stored numbers	•	•	•	
+GMI	Request manufacturer identification	•	•	•	
+GMM	Request model identification	•	•	•	
+GMR	Request revision identification	•	•	•	
+GCAP	Request capabilities list	•	•	•	
+GSN	Request serial number	•	•	•	
&V	Display current configuration & profile	•	•	•	
&V0	Display current configuration & profile	•	•	•	
&V1	Display S registers values	•	•	•	
&V2	Display last connection statistics	•	•	•	
&V3	Display S registers values	•	•	•	
\V	Single line connect message	•	•	•	
%L	Report line signal level	•	•	•	

[1] The AT is an ATTENTION command and is used as a prefix to other parameters in a string. The AT command combined with other parameters can be set up in the communications package or typed in manually as a command line instruction.

%Q	Report line quality	•	•	•	
+GCI	Select the country of installation	•	•	•	
L	Monitor speaker loudness	•	•	•	
M	Monitor speaker mode	•	•	•	
DTE – modem interface control		**QUAD**	**PY**	**GPS**	
E	Command echo	•	•	•	
Q	Quiet resut codes	•	•	•	
V	Result code form	•	•	•	
X	Extended result codes	•	•	•	
I	Request identifier and software checksum	•	•	•	
&C	Data carrier detect (DCD) control	•	•	•	
&D	Data terminal ready (DTR) control	•	•	•	
&K	Flow control	•	•	•	
&Q	Sync/async mode	•	•	•	
&S	Data set ready (DSR) control	•	•	•	
\R	Ring (RI) control	•	•	•	
+IPR	Fixed DTE interface rate	•	•	•	
+IFC	DTE – DTA flow control	•	•	•	
+ILRR	DTE – modem rate reporting	•	•	•	
+ICF	DTE – modem character format	•	•	•	
Call Control		**QUAD**	**PY**	**GPS**	
D	Dial	•	•	•	
T	Set tone dial	•	•	•	
P	Set pulse dial	•	•	•	
A	Answer	•	•	•	
A/	Last command automatic repetition	•	•	•	
H	Disconnect	•	•	•	
O	Return to On Line Mode	•	•	•	
&G	Guard tone	•	•	•	
Modulation control		**QUAD**	**PY**	**GPS**	
+MS	Modulation control	•	•	•	
%E	Enable/disable line quality monitor and auto retrain or fallback / fallforward	•	•	•	
\N	Operating mode	•	•	•	
Compression control		**QUAD**	**PY**	**GPS**	
+DS	Set data compression	•	•	•	
+DR	Data compression reporting	•	•	•	
Break control		**QUAD**	**PY**	**GPS**	
\B	Transmit break to remote	•	•	•	
\K	Break handling	•	•	•	
S parameters		**QUAD**	**PY**	**GPS**	
S0	Number of rings to auto answer	•	•	•	
S1	Ring counter	•	•	•	
S2	Escape character	•	•	•	
S3	Carriage return character	•	•	•	
S4	Line feed character	•	•	•	
S5	Backspace character	•	•	•	

S7	Wait time for carrier, silence or dial tone	•	•	•	
S12	Escape prompt delay	•	•	•	
S25	Delay to DTR off	•	•	•	
S30	Disconnect inactivity timer	•	•	•	
S38	Delay before forced hang up	•	•	•	
ETSI GSM 07.07 AT Commands		**QUAD**	**PY**	**GPS**	
+CGMI	Request manufacturer identification	•	•	•	
+CGMM	Request model identification	•	•	•	
+CGMR	Request revision identification	•	•	•	
+CGSN	Request product serial number identification	•	•	•	
+CSCS	Select TE character set	•	•	•	
+CIMI	Request international mobile subscriber identity (IMSI)	•	•	•	
Call control		**QUAD**	**PY**	**GPS**	
+CBST	Select bearer service type	•	•	•	
+CRLP	Radio link protocol	•	•	•	
+CR	Service reporting control	•	•	•	
+CEER	Extended error report	•	•	•	
+CRC	Cellular result codes	•	•	•	
+CSNS	Single numbering scheme	•	•	•	
Network service handling		**QUAD**	**PY**	**GPS**	
+CNUM	Subscriber number	•	•	•	
+COPN	Read operator names	•	•	•	
+CREG	Network registration report	•	•	•	
+COPS	Operator selection	•	•	•	
+CLCK	Facility lock/ unlock	•	•	•	
+CPWD	Change facility password	•	•	•	
+CLIP	Calling line identification presentation	•	•	•	
+CLIR	Calling line identification restriction	•	•	•	
+CCFC	Call forwarding number and conditions	•	•	•	
+CCWA	Call waiting	•	•	•	
+CHLD	Call holding services	•	•	•	
+CUSD	Unstructured supplementary service data	•	•	•	
+CAOC	Advice of charge	•	•	•	
+CLCC	List current calls	•	•	•	
+CSSN	SS Notification	•	•	•	
+CCUG	Closed User Group supplementary service control	•	•	•	
Mobile Equipment control		**QUAD**	**PY**	**GPS**	
+CPAS	Phone activity status	•	•	•	
+CFUN	Set phone functionality (Power Saving Management)	•	•	•	
+CPIN	Enter PIN	•	•	•	
+CSQ	Signal quality	•	•	•	
+CPBS	Select phonebook memory storage	•	•	•	
+CPBR	Read phonebook entries	•	•	•	
+CPBF	Find phonebook entries	•	•	•	

+CPBW	Write phonebook entry	•	•	•	
+CCLK	Clock Management	•	•	•	
+CALA	Alarm Management	•	•	•	
+CALM	Alert sound mode	•	•	•	
+CRSL	Ringer sound level	•	•	•	
+CLVL	Loudspeaker volume level	•	•	•	
+CMUT	Microphone mute control	•	•	•	
+CACM	Accumulated call meter	•	•	•	
+CAMM	Accumulated call meter maximum	•	•	•	
+CPUC	Price per unit and currency table	•	•	•	
Mobile equipment errors		**QUAD**	**PY**	**GPS**	
+CMEE	Report mobile equipment error	•	•	•	
Voice Control (TIA IS-101)		**QUAD**	**PY**	**GPS**	
+VTS:	DTMF tones transmission	•	•	•	
Commands For GPRS		**QUAD**	**PY**	**GPS**	
+CGACT	PDP context activate or deactivate	•	•	•	
+CGATT	GPRS attach or detach	•	•	•	
+CGDATA	Enter data state	•	•	•	
+CGDCONT	Define PDP context	•	•	•	
+CGPADDR	Show PDP address	•	•	•	
+CGREG	GPRS network registration status	•	•	•	
+CGQMIN	Quality of service profile (minimum acceptable)	•	•	•	
+CGQREQ	Quality of service profile (requested)	•	•	•	
Commands For Battery Charger		**QUAD**	**PY**	**GPS, PY**	
+CBC	Battery Charge	•	•	•	
ETSI GSM 07.05 AT Commands for SMS and CB services		**QUAD**	**PY**	**GPS**	
+CSMS	Select message service	•	•	•	
+CPMS	Preferred message storage	•	•	•	
+CMGF	Message format	•	•	•	
+CSMP	Set parameters in text mode	•	•	•	
+CSDH	Show parameters in text mode	•	•	•	
+CSAS	Save setting text mode	•	•	•	
+CRES	Restore text mode settings	•	•	•	
+CSCB	Select Cell Broadcast Message types	•	•	•	
Message configuration		**QUAD**	**PY**	**GPS**	
+CSCA	Service center address	•	•	•	
Message receiving and reading		**QUAD**	**PY**	**GPS**	
+CNMI	New message indications to Terminal Equipment	•	•	•	
+CMGL	List messages	•	•	•	
+CMGR	Read message	•	•	•	
Message sending and writing		**QUAD**	**PY**	**GPS**	
+CMGS	Send message	•	•	•	
+CMSS	Send message from storage	•	•	•	
+CMGW	Write message to memory	•	•	•	
+CMGD	Delete message	•	•	•	
Custom AT Commands		**QUAD**	**PY**	**GPS**	

#CGMI	Request manufacturer identification	•	•	•	
#CGMM	Request model identification	•	•	•	
#CGMR	Request revision identification	•	•	•	
#CGSN	Request product serial number identification	•	•	•	
#CIMI	Request international mobile subscriber identity (IMSI)	•	•	•	
#CAP	Change Audio Path	•	•	•	
#SRS	Select ringer sound	•	•	•	
#SRP	Select Ringer Path	•	•	•	
#STM	Signalling Tones Mode	•	•	•	
#PCT	Display PIN Counter	•	•	•	
#SHDN	Software Shut Down	•	•	•	
#WAKE	Wake from Alarm mode	•	•	•	
#QTEMP	Query Temperature overflow	•	•	•	
#SGPO	Set General Purpose Output	•	•	•	
#GGPI	Read General Purpose Input	•	•	•	
#GPIO	General Purpose Input/Output pin control	•	•	•	
#ADC	Read Analog/Digital Comverter input	•	•	•	
#VAUX	Auxiliary Voltage Output Control	•	•	•	
#MONI	Monitor Cells	•	•	•	
#QSS	Query SIM Status	•	•	•	
#ACAL	Set Automatic Call	•	•	•	
#SMOV	SMS Overflow	•	•	•	
#SHFEC	Set Handsfree echo canceller	•	•	•	
#HFMICG	Handsfree Microphone Gain	•	•	•	
#HSMICG	Handset Microphone Gain	•	•	•	
#SHFSD	Set Handsfree side tone	•	•	•	
#/	Repeat last command	•	•	•	
#BND	Select Band	•	•	•	
#SKIPESC	Network Timezone	•	•	•	
#NITZ	Skip escape sequence	•	•	•	
FAX Class 1 Commands		**QUAD**	**PY**	**GPS**	
+FCLASS	Select active service class	•	•	•	
+FMI	Report manufacturer ID	•	•	•	
+FMM?	Report model ID	•	•	•	
+FMR	Report revision ID	•	•	•	
Transmission/Reception control		**QUAD**	**PY**	**GPS**	
+FTS	Stop Transmission and pause	•	•	•	
+FRS	Wait for receive silence	•	•	•	
+FTM	Transmit data modulation	•	•	•	
+FRM	Receive data modulation	•	•	•	
+FTH	Transmit data with HDLC framing	•	•	•	
+FRH	Receive data with HDLC framing	•	•	•	
Serial port control		**QUAD**	**PY**	**GPS**	
+FLO	Select flow control specified by type	•	•	•	
+FPR	Select serial port rate	•	•	•	

+FDD	Double escape character replacement control	•	•	•	
Easy GPRS custom AT command Definition		**QUAD**	**PY**	**GPS**	
#USERID	Authentication User ID control	•	•	•	
#PASSW	Authentication Password control	•	•	•	
#PKTSZ	Packet Size control	•	•	•	
#DSTO	Data Sending TimeOut control	•	•	•	
#SKTTO	Socket inactivity timeout control	•	•	•	
#SKTSET	Socket definition control	•	•	•	
#SKTOP	Socket Open command	•	•	•	
#QDNS	Query DNS	•	•	•	
#SKTCT	Socket TCP Connection Timeout	•	•	•	
#SKTSAV	Socket Parameters Save Command	•	•	•	
#SKTRST	Socket Parameters Reset Command	•	•	•	
#GPRS	GPRS context activation control	•	•	•	
#SKTD	Socket Dial	•	•	•	
#SKTL	Socket Listen	•	•	•	
#FRWL	Firewall setup	•	•	•	
FTP Commands		**QUAD**	**PY**	**GPS**	
#FTPOPEN	FTP Open command	•	•	•	
#FTPCLOSE	FTP Close command	•	•	•	
#FTPPUT	FTP Put command	•	•	•	
#FTPGET	FTP Get command	•	•	•	
#FTPTYPE	FTP Type command	•	•	•	
#FTPMSG	FTP Read Message command	•	•	•	
#FTPDELE	FTP Delete command	•	•	•	
#FTPPWD	FTP Print working directory command	•	•	•	
#FTPCWD	FTP Change working directory command	•	•	•	
#FTPLIST	FTP List command	•	•	•	
Easy Camera Extension – Camera Management		**QUAD**	**PY**	**GPS**	
#CAMON	Camera ON	•	•	•	
#CAMOFF	Camera OFF	•	•	•	
#TPHOTO	Camera Take Photo	•	•	•	
#RPHOTO	Camera Read Photo	•	•	•	
#OBJL	Object List	•	•	•	
#OBJR	Object Read	•	•	•	
#CAMQUA	Camera Select Quality of Photo	•	•	•	
#CMODE	Camera Select Operating MODE	•	•	•	
Email management		**QUAD**	**PY**	**GPS**	
#ESMTP	Email SMTP server	•	•	•	
#EADDR	Email sender address	•	•	•	
#EUSER	Email authentication USER NAME	•	•	•	
#EPASSW	Email authentication PASSWORD	•	•	•	
#SEMAIL	Send Email	•	•	•	
#ESAV	Email Parameters Save Command	•	•	•	
#ERST	Email Parameters Reset Command	•	•	•	
Easy Scan Extension		**QUAD**	**PY**	**GPS**	

#CSURV	Network Survey of the complete 900/1800/1900 Network	•	•	•	
#CSURVC	Network Survey in computer friendly format	•	•	•	
#CSURVU	Network Survey of user defined 900/1800/1900 channels	•	•	•	
#CSURVUC	Network Survey in computer friendly format	•	•	•	
#CSURVF	Network Survey Format	•	•	•	
Jammed Detect & Report custom AT command		**QUAD**	**PY**	**GPS**	
#JDR	Jammed Detect & Report	•	•	•	
Python Easy Script Extension Commands		**QUAD**	**PY**	**GPS**	
#WSCRIPT	Write script command		•	•	
#ESCRIPT	Select Active script command		•	•	
#RSCRIPT	Read script command		•	•	
#LSCRIPT	List script names command		•	•	
#DSCRIPT	Delete script command		•	•	
#REBOOT	Reboot command		•	•	
GPS Commands		**QUAD**	**PY**	**GPS**	
$GPSP	GPS Controller Power management			•	
$GPSR	GPS Reset			•	
$GPSSW	GPS Software Version			•	
$GPSAT	Configure GPS Antenna Type			•	
$GPSAV	GPS Antenna Voltage Readout			•	
$GPSAI	GPS Antenna Current Monitor			•	
$GPSAP	GPS Antenna Protection System			•	
$GPSS	GPS Serial Port Speed			•	
$GPSNMUN	Unsolicited NMEA Data Configuration			•	
$GPSACP	Get Actual Position			•	
$GPSWRB	Send Binary data to GPS module			•	
$GPSWRS	Send ASCII string to GPS module			•	
$GPSSAV	Save GPS parameters			•	
$GPSRST	Restore all GPS parameters			•	

7 Conformity Assessment Issues

The Telit GE863 modules is assessed to be conform to the R&TTE Directive as stand-alone product, 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 Telit GE863 modules are conforming to 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 GE863 module 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

Furthermore the Telit GE863 modules are FCC Approved as module to be installed in other devices. These devices have to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, a new application and FCC ID is required.

The Telit GE863 modules are conforming to the following US Directives:

- Use of RF Spectrum. Standards: FCC 47 Part 24 (GSM 1900)
- EMC (Electromagnetic Compatibility). Standards: FCC47 Part 15

To meet the FCC's RF exposure rules and regulations:

- The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
- The antenna(s) used for this module must not exceed 3 dBi for mobile and fixed or mobile operating configurations.

Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Manufacturers of mobile, fixed or portable devices incorporating this module are advised to clarify any regulatory questions and to have their complete product tested and approved for FCC compliance.

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

7.1 GE863 : Conformity Assessment

Under approval

7.2 GE863 : FCC Equipment Authorization

Under approval

8 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 people (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

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

9 GE863 Technical Support

Telit's technical support to **GE863** wireless modem customers consists in:

• Technical documentation: available for download into the Website www.telit.com >Products >Modules > selected model.
• Engineering support: accessible via E-Mail service with 48 hr replies assured under normal conditions.

10 List of acronyms

ACM	Accumulated Call Meter
ASCII	American Standard Code for Information Interchange
AT	Attention commands
BGA	Ball Grid Array (of solder balls on surface mount devices)
CB	Cell Broadcast
CBS	Cell Broadcasting Service
CCM	Call Control Meter
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CMOS	Complementary Metal-Oxide Semiconductor
CR	Carriage Return
CSD	Circuit Switched Data
CTS	Clear To Send
DAI	Digital Audio Interface
DCD	Data Carrier Detected
DCE	Data Communications Equipment
DRX	Data Receive
DSR	Data Set Ready
DTA	Data Terminal Adaptor
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Equipment Institute
FTA	Full Type Approval (ETSI)
FTP	File Transfer Protocol
GGA	GPS ????
GPS	Global Positioning System, based on reception of signals from orbiting satellites
GPRS	General Radio Packet Service
GSM	Global System for Mobile communication
HF	Hands Free
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IRA	Internationale Reference Alphabet
ITU	International Telecommunications Union
IWF	Inter-Working Function
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Linefeed
ME	Mobile Equipment
MMI	Man Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NMEA	National Marine Electronics Association
OEM	Other Equipment Manufacturer

PB	Phone Book
PDU	Protocol Data Unit
PH	Packet Handler
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PUCT	Price per Unit Currency Table
PUK	PIN Unblocking Code
RACH	Random Access Channel
RLP	Radio Link Protocol
RMS	Root Mean Square
RoHS	Reduction of Hazardous Substances
RTS	Ready To Send
RI	Ring Indicator
SCA	Service Center Address
SIM	Subscriber Identity Module
SMD	Surface Mounted Device
SMS	Short Message Service
SMSC	Short Message Service Center
SS	Supplementary Service
TIA	Telecommunications Industry Association
TTFF	Time To First Fix
UDUB	User Determined User Busy
USSD	Unstructured Supplementary Service Data

11 Document Change Log

Revision	Date	Changes
ISSUE#0	18/04/05	Release First ISSUE
ISSUE #1	01/09/05	Company name, 2.16, 2.19, 6
ISSUE #2	12/11/05	Paragraphs reviewed: 1 Overview 2.3.1 Temperature range 2.6 Reference sensitivity 2.7.1 GSM Antenna 2.8 GPS Module features 2.8.1.1 GPS Sensitivity 2.8.1.2 GPS Consumption 2.12.9 Character management 2.12.12 Indication of network service availability 2.18.1 ADC Converter 2.18.2 DAC Converter 2.19 Board to Board interface of GE863 vs TRIZIUM pin 64, not TX monitor indicator while is on GPIO5 2.20.3 Recommended foot-print for the application 2.20.10 Packing system 4 AT Commands (FTP cmds, GPS cmds, #NITZ, #SKIPESC)