LT70-868 Terminal User Guide

1VV0301096 Rev.2 – 2015-05-08

Making machines talk.

APPLICABILITY TABLE

PRODUCT
LT70-868 TERMINAL

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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Contents

1. Introduction

1.1. Scope

The aim of this document is to present the hardware features and the application of LT70-868 Radio Terminal. The LT70 is a terminal equipped with a Telit module LE70-868 and all its functionalities are supported except Telemetry.

1.2. Audience

This document is intended for Telit customers and operators who are interested in installing LT70-868 terminals.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:

Chapter 1: Introduction provides a scope for this document, target audience, contact and support information, and text conventions.

Chapter 2: Product Description gives an overview of the features of the product.

Chapter 3: Mechanics and Connections describes in details the characteristics of the product.

Chapter 4: Annexes : installation procedure, applicable regulations overview, and other useful information.

Chapter 5: Declaration of Conformity shows conformity assessment documentation for European Directive 1999/05/EC (R&TTE).

Chapter 6: Safety Recommendations provides some safety recommendations that must be follow by the customer in the design of the application that makes use of the LT70-868.

Chapter 7: Document History describes the history of the present product.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

- **[1] EN 300 220-2 v2.4.1:** ETSI Standards for SRD , May 2012
- **[2] ERC Rec 70-03** ERC Recommendation for SRD, October 2012
- **[3] 2002/95/EC** Directive of the European Parliament and of the Council, 27 January 2003
- **[4] LE70-868 module : User Manual**
  1vv0301037_Telit_xE70_868_RF_Module_User_Guide
- **[5] Star Network Protocol : User Manual**
  1vv0300873_Telit_Star_Network_Protocol_Stack_User_Guide
- **[6] SR Manager Tool: User Guide**
  1vv0300899_Telit_SR_Manager_Tool_User_Guide

2. Product Description

The LT70-868 terminal is a multi-channel radio terminal, delivering up to 500mW in the 868MHz ISM band (unlicensed frequency band).
It allows ‘point-to-point’ or `multipoint’ functioning modes.

2.1. 868 MHz band requirements

The “ERC recommendation 70-03” describes the different usable sub-bands in the 868MHz license free band, in terms of bandwidth, maximum power, duty cycle and channel spacing. It gives the following limitations:

ERC recommendation 70-03				
Band	Frequency (MHz)	Maximum radiated power (mW)	Channel spacing (kHz)	Duty cycle (%)
Annex1 g1.3	869.4 – 869.65	500	25 or wideband	10

This band is free to use but the terminal and the user must respect the 10% duty cycle limitation. This means that each terminal is limited to a total transmit time of 6 minutes per hour. It is the responsibility of the user to respect it.

Furthermore, the terminal complies with the ETSI 300-220-2 v2.4.1 (specific for SRD). The main requirements are described in chapter IV.3.

Finally, the terminal complies with the new European Directive 2002/95/EC concerning the Restrictive Usage of Hazardous Substances (RoHS).

National restrictions for no specific short range devices Annex 1 band g3:

Country	Restriction	Reason/Remark
Band g3		
Georgia	Not implemented	
Russian Federation	Not implemented	
Ukraine	Not implemented	

2.2. Temperature requirements

	Minimum	Typical	Maximum	Unit
Operating				
Temperature	-40	25	+85	°C
Relative humidity	20		75	%
Storage				
Temperature	-40	25	+85	°C
Relative humidity	0		95	%

2.3. Mechanical characteristics

Characteristic		Unit
Connectors	Connection using terminal blocks inside the casing. Exit through cable gland	-
Box dimensions	100 × 66 × 47	mm

2.4. DC Characteristics

Characteristic	6V	12V	20V	Unit
Transmission consumption 500mW / 100mW / 40mW	195 / 162 / 107	90/ 73 / 47	49 / 40/ 23	mA
Reception consumption	47	17.6	4.8	mA
Stand-by consumption	0.1	0.11	<0.112	mA

2.5. Functional Characteristics

ERC Rec 70-03 Frequency band	Band g3: 869.400 MHz – 869.650 MHz						
RF datarates	**1.2 kbps**	**2.4 kbps**	**4.8 kbps**	**9.6 kbps**	**19.2 kbps**	**38.4 kbps**	**57.6 kbps**
Number of channels	1						
Channel width	250 kHz						
Channel 0	869.525 MHz						
Total Bandwidth	250 kHz						
Transmission							
Duty cycle	≤ 10%						
Modulation format	2GFSK						
Deviation	±0.6 kHz	±1.2 kHz	±7 kHz	±7 kHz	±10 kHz	±20 kHz	±30 kHz
Frequency tolerance at 25 °C	± 2.5 kHz						
RF output power at 3.6 V	Selectable by software (see Protocol Stack User Guide [5]) From + 15dBm to + 27dBm						

Reception							
Rx filter BW	20 kHz	20 kHz	20 kHz	27 kHz	44 kHz	81 kHz	122 kHz
Conducted Sensitivity for PER	-118.5 dBm	-119 dBm	-117 dBm	-113.5 dBm	-112 dBm	-109.5 dBm	-108 dBm
Total Isotropic Sensitivity for PER < 0.8 (*)	-116.5 dBm	-117 dBm	-115 dBm	-111.5 dBm	-110 dBm	-107.5 dBm	-106 dBm

(*) Estimated value based on the antenna efficiency value

ERC Rec 70-03 Frequency band	Band g3: 869.400 MHz – 869.650 MHz (channelized operation)
RF datarate	**4.8 kbps**
Number of channels	10
Channel width	25 kHz
Channel 0	869.4125 MHz
Total Bandwidth	250 kHz
Transmission	
Duty cycle	≤ 10%
Modulation format	2GFSK
Deviation	2.4 kHz
Frequency tolerance at 25 °C	± 2.5 kHz
RF output power at 3.6 V	Selectable by software (see Protocol Stack User Guide [5]) From + 15dBm to + 23dBm
Reception	
Rx filter BW	15 kHz
Sensitivity for PER < 0.8, CH1/CH5/CH10	-117 dBm / -117 dBm / -117 dBm
Total Isotropic Sensitivity for PER<0.8(*) CH1/CH5/CH10	-115 dBm / -115 dBm / -115 dBm

(*) Estimated value based on the antenna efficiency value

	Indian Frequency Band: 865 MHz - 867 MHz			
RF data rate	**4.8 kbps**	**9.6 kbps**	**19.2 kbps**	**38.4 kbps**
Numbers of channels	10			
Channel width	200 kHz			
Channel 0	865.1 MHz			
Total Bandwidth	2 MHz			
Transmission				
Modulation Format	2GFSK			
Deviation	± 7 kHz	± 7 kHz	± 10 kHz	± 20 kHz
Frequency tolerance at 25°C	+/- 2.5 kHz			
RF Output Power at 3.6V	Selectable by software (see Protocol Stack User Guide [7][8])			
	From +15 dBm to +27dBm			
Reception				
Rx filter BW	20 kHz	27 kHz	44 kHz	81 kHz
Sensitivity [dBm] for PER < 0.8 CH0/CH4/CH9	-116 / -116 / -116.5	-114.5 / -114.5 / -114.5	-112.5 / -112.5 / -112.5	-110 / -109 / -110
Total Isotropic Sensitivity for PER<0.8(*) CH0/CH4/CH9	-114 / -114 / -114.5	-112.5 / -112.5 / -112.5	-110.5 / -110.5 / -110.5	-108 / -107 / -108

(*) Estimated value based on the antenna efficiency value

2.6. Digital Characteristics

Funtion	Characteristics
µC	• 128 kB + 8kB in system programmable flash • 8 kB RAM • 2 kB EEPROM
Serial link	• RS-232 TTL Full Duplex • 1200 to 115200 bps • 7 or 8 bits • Parity management • Flow control o Hardware (RTS/CTS)
Embedded software functionality	• Flexibility o Pre-flashed o Customization capability o Embedded bootloader for firmware download through serial link or over-the-air

2.7. Ordering information

The appropriate Telit part number you need to order LT70-868 Terminal is **3990150524.**

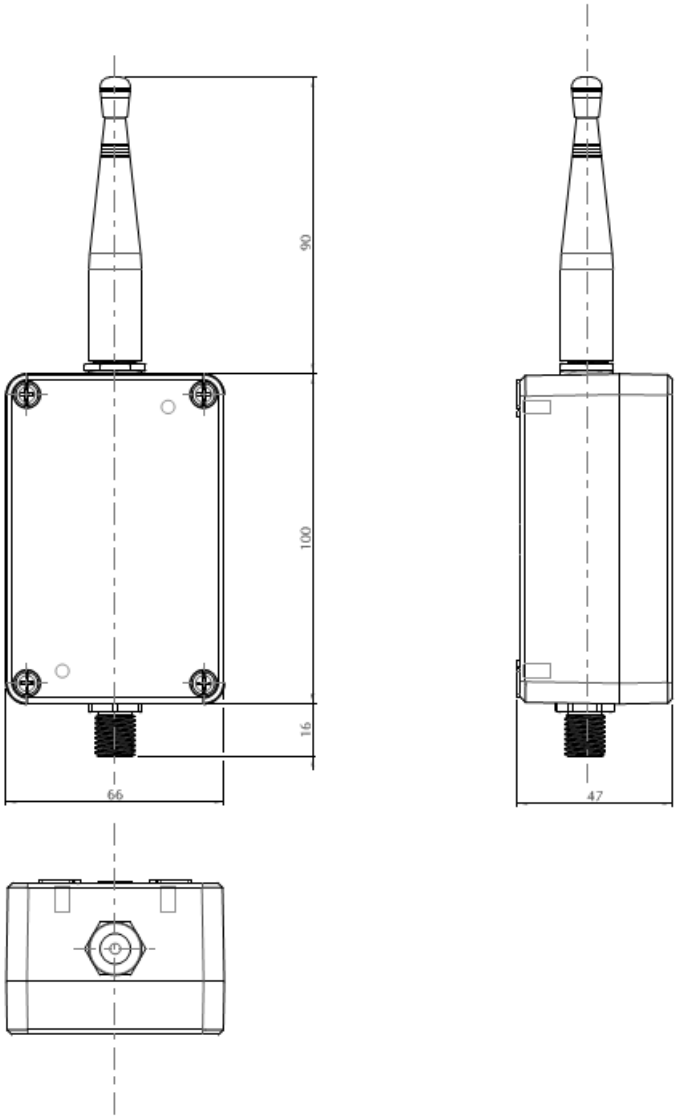
2.8. Accessories

The LT868-Terminal box could be integrated with two wall fastening lugs **FIBOX MRS-28540** (product number 7028540):

3. Mechanics and connections

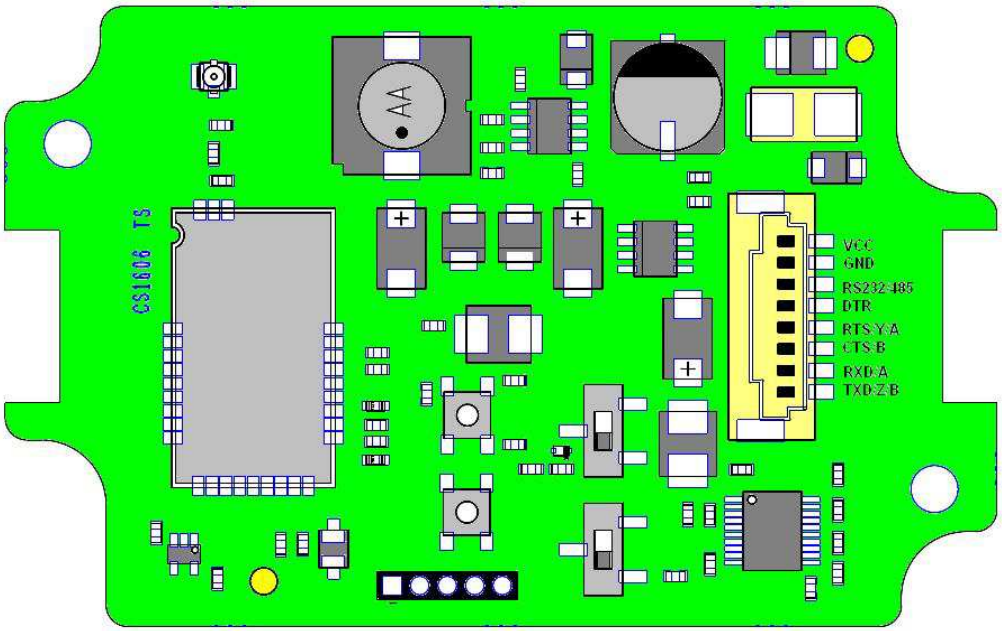
3.1. Mechanical characteristics

The LT70-868 Terminal features an IP67 casing.



3.2. Connections

The terminal will communicate with the host through a cable connected to a matching connector on the mother board inside the casing (yellow part on the following drawing):



The following table gives a description for each signal:

Pin Name	Description
TxD, RxD	Serial link signals in RS232 format. TxD is for the data going out of the Terminal while RxD is for the data coming into the Terminal. The logic '1' is represented by signal between –3 and –15V
CTS	Clear To Send: signal into the Terminal. Indicates if the Terminal can send serial data to the User (Active on '0', +3V to +15V) or not (Inactive on '1', -15V to -3V).
RTS	Request To Send: signal going out of the Terminal. Indicates that the user can transmit serial data (Active on '0', +3V to +15V) or not (Inactive on '1', -15V to -3V).
DTR	Stand-By signal into the Terminal. Switches the Terminal in Low-Power Mode ('1', -15V to -3V) or in Normal Mode ('0', +3V to +15V).
RS-232/485	Used with the S215 Register, selects the type of serial link: open for RS232 (default, internal pull up 100 KΩ), GND for RS422 or RS485. Can be also made by RS232/485 switch. Note: by default, the supplied cable is cabled to work in RS232 protocol, if you want communicate in RS422/485 protocol, change the cable in according with the pin-out listed in Cap.3.3.
A, B, Y, Z	RS422/RS485 signals. For RS422 use A (or Rx+), B (or Rx-), Y (or Tx+) and Z (or Tx-). For RS485, use only A (or D+) and B (or D-).
6-40V	6 to 40 VDC power supply. There is no internal ON/OFF switch for the power supply. The switch off capability should be external

Intenal LEDs:

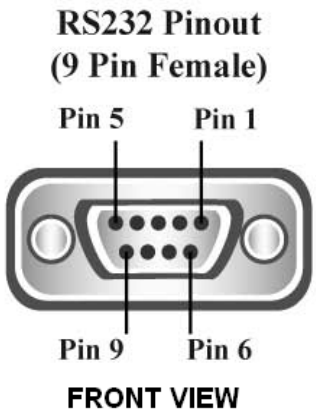
- Green LED: it is switched on when the terminal is transmitting data
- Red LED: it is switched on when the terminal is receiving data

3.3. Cables description

The associated cable is connected to the matching connector of the mother board and goes out of the terminal through a cable gland. The cable must be shielded and have an external diameter between 3.5 and 7mm. The conductors must have a cross section of 0.22mm² (24AWG).

By default, the supplied cable is set up to work in RS232 protocol:

Case of RS-232				
Connector (8 pins)	**Name Terminal side**	**Color**	**Name PC/Automate side**	**Sub-D connector (9 pins)**
1	TxD (Trasnmit Data)	Blue	RxD (Receive Data)	2
2	RxD (Receive Data)	White	TxD (Transmit Data)	3
3	CTS (Clear To Send)	Brown	RTS (Request To Send)	7
4	RTS (Request To Send)	Yellow	CTS (Clear To Send)	8
5	DTR (Data Terminal Ready)	Green	DTR (Data Terminal Ready)	4
6	RS-232/422/485	Orange	Open	N.C.
7	GND (Ground)	Black	GND (Ground)	5
8	VCC (6 to 40 V)	Red	VCC (6 to 40 V)	N.C.



In order to communicate in RS422/485 protocol, change the supplied cable according to the pin-out listed below:

Case of RS-422/485 FULL DUPLEX				
Connector (8 pins)	**Name Terminal side**	**Color**	**Name Automate side**	**Connector Sub-D (9 points)**
1	Z or TX-	Blue	B or RX-	2
2	A or RX+	White	Z or TX+	3
3	B or RX-	Brown	Y or TX-	7
4	Y or TX+	Yellow	A or RX+	8
5	DTR	Green	Open	N.C.
6	RS-232/422/485	Orange	GND (Ground) and: S215=1 (RS422) or S215=3 (RS485)	5 if RS232/485 switch is not used, else N.C.
7	GND(Ground)	Black	GND (Ground)	5
8	VCC (6 to 40 V)	Red	VCC (6 to 40 V)	N.C.

Case of RS-485 HALF DUPLEX				
Connector (8 pins)	**Name Terminal side**	**Color**	**Name Automate side**	**Connector Sub-D (9 points)**
1	B (Data-)	Blue	B (Data-)	2
2	Open	White	Open	N.C.
3	Open	Brown	Open	N.C.
4	A (Data+)	Yellow	A (Data+)	8
5	DTR	Green	Open	N.C.
6	RS-232/422/485	Orange	GND (Ground) and S215=2	5 if RS232/485 switch is not used, else N.C.
7	GND(Ground)	Black	GND (Ground)	5
8	VCC (6 to 40 V)	Red	VCC (6 to 40 V)	N.C.

4. Annexes

4.1. Terminal's installation: Principles and Cautions

You must use the power supply and serial cable provided by Telit with the terminal. Take care of the polarity for the power supply connection (red wire +Vcc, black wire GND).

The ON/OFF switching capability of the power supply is external to the terminal.

The radio environment should be closely studied prior to any installation with a spectrum analyzer in order to determine whether and where the installation will be optimal.

In case of outdoor installations, IP casings are recommended.

In case of a ceiling installation, the terminal should be mounted upside down for a better radiation.

A 1 m distance between two terminals should be respected under 25mW power output, at least 2 m at 100mW and 3m at 500mW.

The terminals should be located as high and as free as possible so that a line of sight propagation is established between terminals.

The terminal should not be surrounded by metallic masses because of the disturbances caused by a reflection phenomena.

Electrical disturbances can come from various sources, and should be avoided. Examples include:

- Engines
- High current devices
- Power relays, transformers

Radio disturbances should be avoided as well:

- Systems in the same frequency band, such as car remote control systems
- Systems in a nearby frequency band, such as high power (2W) walkie-talkie systems

Vibrations and/or shocks can also be source of disturbances. It is therefore advised to mount the terminals in silent-blocks in order to stabilize it whenever necessary.

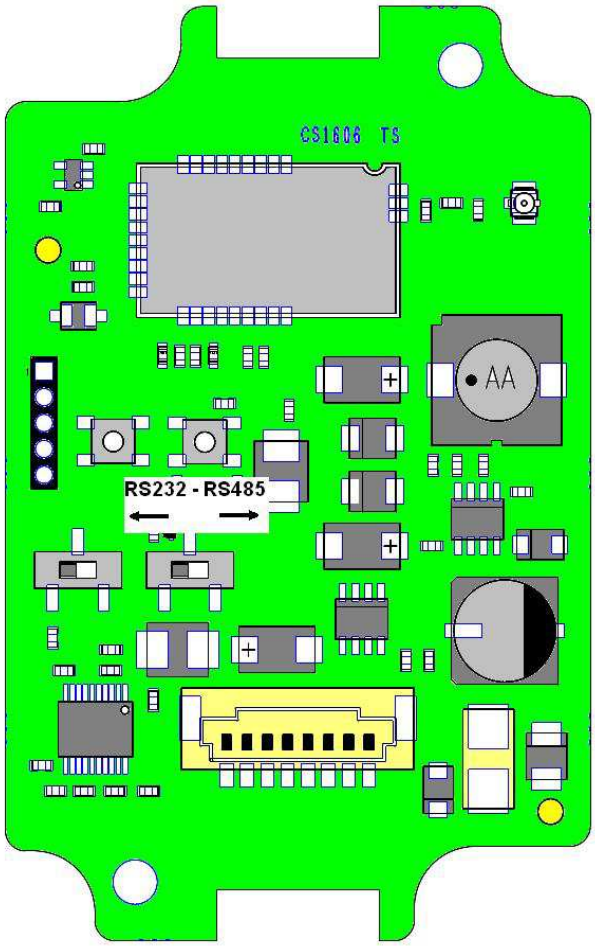
Distances, obstacles and weather conditions can strongly affect radio communications and cause disturbances as well as communication breakdowns.

4.2. Connection to a RS-422 or RS-485 Interface

LT70-868 terminal is configured in RS232 mode by default (S215=0): it allows connect it directly on a PC serial port.

To configure the terminal in RS422 or RS485 mode:

- Go to Hayes Mode and configure the S215 register
  - Set to ‘1’ for RS-422
  - Set to ‘2’ for RS-485 Half Duplex
  - Set to ‘3’ for RS-485 Full Duplex
- Power OFF the Terminal
- Connect the RS-845 or RS-422 serial link to the Terminal
- Connect the RS232-485 pin to GND or set the RS232/485 switch to RS485 side
- Power ON the Terminal

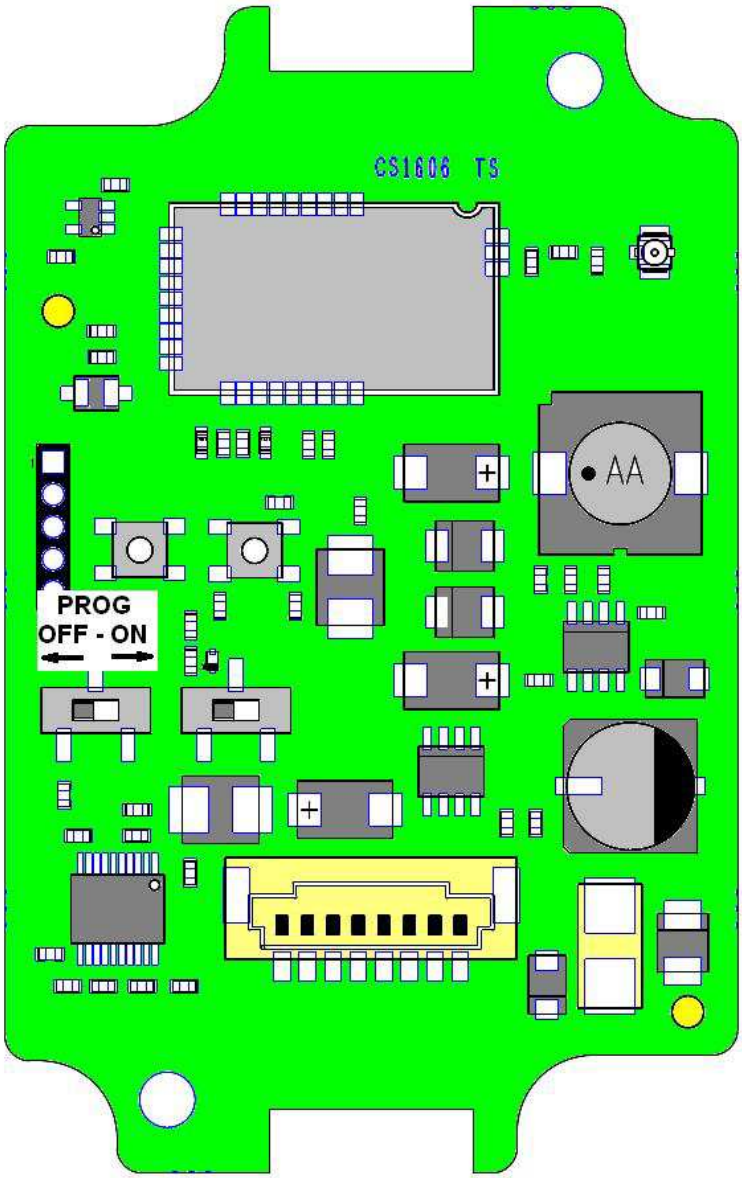


Please note: if you power OFF the board and set RS232-485 pin open, RS485/RS422 is inactivated and RS232 is activated.

4.3. Terminal reflashing

LT70-868 terminals are re-flashable through the serial link.

In order to re-flash the terminal, switch off the power supply, open the casing, put the "PROG" switch on "ON" position, and switch on the power supply. Refer to its SR Manager Tool User Guide (**[6]**) for detailed explanation



4.4. ETSI 300 220-2 version 2.4.1 standards (summary)

Limits allowed by ETSI standard				
Transmission				
Frequency error	≤ +/- 12.5 kHz @ 25 kHz channelization +/- 87 kHz (+/-100 ppm) > 25 kHz channelization 10%			
ACP for channels ≤25kHz	- 37 dBm in 16 kHz “receiver” filter BW under normal test conditions - 32 dBm in 16 kHz “receiver” filter BW under extreme test conditions			
Modulation BW	Reference BW	Limit	Lower envelope point Minimum frequency	Upper envelope point Maximum frequency
	1 kHz	- 30 dBm (1 µW)	fe, lower	fe, upper
	1 kHz	- 36 dBm (250 nW)	(fe, lower – 200 kHz)	(fe, upper + 200 kHz)
	10 kHz	- 36 dBm (250 nW)	(fe, lower – 400 kHz)	(fe, upper + 400 kHz)
	100 kHz	- 36 dBm (250 nW)	(fe, lower – 1 MHz)	(fe, upper + 1 MHz)
Unwanted emissions in the spurious domain	Frequency	47 MHz to 74 MHz 7,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
	State			
	Operating	- 54 dBm (4 nW)	- 36 dBm (250 nW)	- 30 dBm (1 µW)
	Standby	- 57 dBm (2 nW)	- 57 dBm (2 nW)	- 47 dBm (20 nW)

Reception			
Blocking for class 2 equipment	Frequency offset of the unwanted signal	Receiver bandwidth	Minimum offset between wanted and unwanted signals
	+/-2 MHz	15 kHz	≥ 35 dB
		25 kHz	≥ 33 dB
		81 kHz	≥ 28 dB
		122 kHz	≥ 26 dB
	+/-10 MHz	15 kHz	≥ 60 dB
		25 kHz	≥ 58 dB
		81 kHz	≥ 53 dB
		122 kHz	≥ 51 dB
Spurious radiation	Below 1000 MHz	Above 1000 MHz	
	- 57 dBm (2 nW)	- 47 dBm (20 nW)	

4.5. Examples of propagation attenuation

Environment	433 MHz		868 MHz		2.4 GHz	
	Loss	Attenuation	Loss	Attenuation	Loss	Attenuation
Open space	0%	0 dB	0%	0 dB	0%	0 dB
Window	< 5%	<1 dB	15%	1-2 dB	30%	3 dB
Thin wall (plaster)	25 %	3 dB	35 %	3 – 4 dB	50 %	5 – 8 dB
Medium wall (wood)	40 %	4 – 6 dB	50 %	5 – 8 dB	70 %	10 – 12 dB
Thick wall (concrete)	50 %	5 – 8 dB	60 %	9 – 11 dB	85 %	15 – 20 dB
Armoured wall (reinforced concrete)	70 %	10 – 12 dB	80 %	12 – 15 dB	90 %	20 – 25 dB
Floor or ceiling	50 %	5 – 8 dB	60 %	9 – 11 dB	85 %	15 – 20 dB
Armoured floor or ceiling	70 %	10 – 12 dB	80 %	12 – 15 dB	90 %	20 – 25 dB
Rain and/or Fog	90 %	20 – 25 dB	95 %	25 – 30 dB	?? *	?? *

* : Attenuation increases along with frequency. In some cases, it is therefore difficult to determine loss and attenuation value.

Please note: the table above is only indicative. The real values will depend on the installation environment.

5. Declaration of Conformity

EC DECLARATION OF CONFORMITY

Telit Communications S.p.A.

1. **LT70-868** (product name)
2. Telit Communications S.p.A -Via Stazione di Prosecco 5/b, 34010 Sgonico, Trieste - Italy (manufacturer)
3. This declaration of conformity is issued under the sole responsibility of the manufacturer
4. Radio Module for Application in 869.4-869.65 MHz band


5. The object of the declaration described above is in conformity with the relevant Community harmonisation: European Directive 1999/05/EC (R&TTE)
6. The conformity with the essential requirements of the 1999/05/EC has been demonstrated against the following harmonized standards:

EN 60950-1:2006 + A11:2009 + A1: 2010 + A12: 2011	For article 3.1 (a): Health and Safety of the User
EN 301 489-1 v 1.9.2 EN 301 489-3 v 1.4.1	For article 3.1 (b): Electromagnetic Compatibility
EN 300 220-1 v 2.4.1 EN 300 220-2 v 2.4.1	For article 3.2: Effective use of spectrum allocated

7. The conformity assessment procedure referred to in Article 10 and detailed in Annex V of Directive 1999/05/EC has been followed with the involvement of the following Notified Body:
CETECOM ICT Services GmbH Untertürkheimer Straße 6-10, D-66117 Saarbrücken, Germany .
Notified Body Number: 0682

Thus, CE 0682 is placed on the product

8. The Technical Construction File (TCF) relevant to the product described above and which supports this Declaration of Conformity, is held at: Telit Communications S.p.A Via Stazione di Prosecco, 5/b 34010 Sgonico (TRIESTE) ITALY

Signed for and on behalf of Telit Communications S.p.A

Trieste, ***2014-04-30***

Quality Director
Guido Walcher

Quality Manager
Cesare Robelli

Technical Construction File :	30406TCF00042A_rev0

Mod 0211 2012-11 Rev.2 (768/2008/EC)

6. Safety Recommendations

READ CAREFULLY

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

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.
The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has
to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

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://ec.europa.eu/enterprise/sectors/rtte/documents/

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

http://ec.europa.eu/enterprise/sectors/electrical/

7. Document History

Revision	Date	Changes
0	2014-01-10	First issue
1	2014-02-27	Change Chapters 3.2 and 3.3
2	2015-05-08	Removed from product description ‘mesh’ functioning mode