LE920 Product Description

80407ST10118A rev.3 - 2014-08-13

Making machines talk.

APPLICABILITY TABLE

PRODUCT
LE920-EUG
LE920-NAG

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Notice

While reasonable efforts have been made to assure the accuracy of this document, Telit assumes no liability resulting from any inaccuracies or omissions in this document, or from use of the information obtained herein. The information in this document has been carefully checked and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies or omissions. Telit reserves the right to make changes to any products described herein and reserves the right to revise this document and to make changes from time to time in content hereof with no obligation to notify any person of revisions or changes. Telit does not assume any liability arising out of the application or use of any product, software, or circuit described herein; neither does it convey license under its patent rights or the rights of others.

It is possible that this publication may contain references to, or information about Telit products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that Telit intends to announce such Telit products, programming, or services in your country.

Copyrights

This instruction manual and the Telit products described in this instruction manual may be, include or describe copyrighted Telit material, such as computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and its licensors certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Telit and its licensors contained herein or in the Telit products described in this instruction manual may not be copied, reproduced, distributed, merged or modified in any manner without the express written permission of Telit. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, 3 stoppels, or otherwise, any license under the copyrights, patents or patent applications of Telit, as arises by operation of law in the sale of a product.

Computer Software Copyrights

The Telit and 3rd Party supplied Software (SW) products described in this instruction manual may include copyrighted Telit and other 3rd Party supplied computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and other 3rd Party supplied SW certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Telit or other 3rd Party supplied SW computer programs contained in the Telit products described in this instruction manual may not be copied (reverse engineered) or reproduced in any manner without the express written permission of Telit or the 3rd Party SW supplier. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, 3stoppels, or otherwise, any license under the copyrights, patents or patent applications of Telit or other 3rd Party supplied SW, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

Usage and Disclosure Restrictions

License Agreements

The software described in this document is the property of Telit and its licensors. It is furnished by express license agreement only and may be used only in accordance with the terms of such an agreement.

Copyrighted Materials

Software and documentation are copyrighted materials. Making unauthorized copies is prohibited by law. No part of the software or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Telit

High Risk Materials

Components, units, or third-party products used in the product described herein are NOT fault-tolerant and are NOT designed, manufactured, or intended for use as on-line control equipment in the following hazardous environments requiring fail-safe controls: the operation of Nuclear Facilities, Aircraft Navigation or Aircraft Communication Systems, Air Traffic Control, Life Support, or Weapons Systems ("High Risk Activities"). Telit and its supplier(s) specifically disclaim any expressed or implied warranty of fitness for such High Risk Activities.

Trademarks

TELIT and the Stylized T Logo are registered in Trademark Office. All other product or service names are the property of their respective owners.

Copyright © Telit Communications S.p.A.

Contents

1. Introduction 7
1.1. Scope 7
1.2. Audience 7
1.3. Contact Information, Support 7
1.4. Text Conventions 7
1.5. Related Documents 8

2. The LE920 9
2.1. Product Overview 9
2.2. Target Market 10
2.3. Product Variants 11
2.4. Product Features 12
2.4.1. LE920 Common Product Features 12
2.4.2. LE920-EUG Product Features 13
2.4.3. LE920-NAG Product Features 14

3. Product Description 16
3.1. Size and 2D mechanical drawing 16
3.2. Weight 17
3.3. Environmental requirements 17
3.3.1. Temperature range 17
3.3.2. RoHS compliance 17
3.4. Operating Frequency 18
3.4.1. LE920-EUG 18
3.4.2. LE920-NAG 19
3.5. Transmitter output power 20
3.6. Antenna 20
3.7. Supply voltage 20
3.8. Power consumption (preliminary) 21
3.9. The user interface 21
3.10. Inputs and Outputs 22
3.10.1. General Purpose I/Os 22
3.10.2. Power on monitor (PWR_MON) 22
3.10.3. Power on/off control (ON_OFF) 22

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.10.4. Auxiliary power output for accessory (VAUX) 22
3.10.5. SIM Reader 22
3.10.6. Serial Ports 22
3.10.7. USB port 22
3.11. Converters 23
3.11.1. ADC Converter 23
3.11.2. DAC Converter 23
3.12. Logic level specifications 23
3.13. Audio 23
3.13.1. Analog 23
3.13.2. Digital 24
3.14. Other features 24
3.14.1. Speech CODEC 24
3.14.2. SMS 24
3.14.3. Phonebook 24
3.14.4. Call status indication 24
3.15. Mounting the LE920 on your Board 24
3.16. Packing system 24

4. Evaluation Kit 26
4.1. AT Commands 27
4.2. Safety Recommendations 27

5. List of acronyms 29

6. Document History 31

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

1. Introduction

1.1. Scope

Scope of this document is to give an overview of the Telit LE920 series, which can support LTE, with data/voice capabilities, and GSM/GPRS/UMTS/HSPA+ as fallback technologies.

1.2. Audience

This document is intended for customers who are evaluating the LE920 series.

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. Text Conventions

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

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.

1.5. Related Documents

- LE920 Hardware User Guide, 1vv0301026
- AT Command User Guide, 80407ST10116a
- xE920 Audio Setting Application Note, 80404NT10095A

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

2. The LE920

2.1. Product Overview

The new Telit LE920 represents the next generation of Telit Automotive form factor xE920. The LE920 combines the two cutting edge technologies HSPA+ and LTE. In fact, LE920 combines a 3.5G wireless data module offering HSPA+ connectivity with download speeds up to 42 Mbps, and a 4G M2M module at the same time, providing an ultra high-speed downlink at 100 Mbps.

Designed for use in the most demanding automotive applications and manufactured according ISO TS16949, the LE920 offers ruggedized LGA packaging for its increased robustness and cost effective mating solution. Two LE920 regional versions are available, one for European, APAC and Latin American markets and one for the North American market. Both of them come with a multiband configuration, covering different sets of 3G and 4G bands. LE920 paired with its 3.5G companion HE920 offers an Automotive LGA family in a common package. Developers can take advantage of Telit's xE920 Unified Form Factor that enables a "design once, use anywhere" strategy. Design your application once and choose the technology that best fits the regional requirements for a truly seamless deployment. The LE920 is also fully backwards compatible to existing EDGE and GSM/GPRS networks through integrated quad-band radios. Additional features, such as integrated TCP/IP and UDP stack, DAC and ADC channels provide extended functionality, adding value to the final application with no additional costs. Moreover LE920 is also available with embedded GPS/GLONASS receiver and Antenna Diversity. The extensive interface set, which includes USB, UART and user definable GPIOs, provides ease of integration of peripherals and actuators.

NOTE:

Some of the performances of the Telit modules depend on S/W version installed on the module itself. The Telit modules S/W group is continuously working in order to add new features and improve the overall performances. The Telit modules are easily upgraded by the developer using the Telit Flash Programmer.

NOTE:

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

- Telit Evaluation Kit EVK2 to help you to develop your application;
- A website with all updated information available;
- An high level specialist technical support team to assist you in your development;

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

2.2. Target Market

The LE920 is designed and developed for the usage in most demanding automotive applications.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

2.3. Product Variants

	Radio Access Technology	Band	Frequency	DL / UL
LE920-EUG	LTE FDD	1	2100	100/50 Mbps
		3	1800	
		7	2600	
		8	900	
		20	800	
	3G / HSPA+	1	2100	42/5.7 Mbps
		3	1800	
		8	900	
	GSM	2	1900	296/236.8 Kbps
		3	1800	
		5	850	
		8	900	

	Radio Access Technology	Band	Frequency	DL / UL
LE920-NAG	LTE FDD	1	2100	100/50 Mbps
		2	1900	
		4	1700/2100	
		5	850	
		17	700	
	3G / HSPA+	1	2100	42/5.7 Mbps
		2	1900	
		4	1700/2100	
		5	850	
		6	800	
	GSM	2	1900	236.8/118.4 Kbps
		3	1800	
		5	850	
		8	900	

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

2.4. Product Features

2.4.1. LE920 Common Product Features

- Supply voltage range: 3.3 – 4.2 V DC (3.8 V DC nominal)
- Control via AT commands according to 3GPP 27.005, 27.007 and Telit custom AT commands
- SIM Application Toolkit 3GPP TS 51.014
- SIM Access Profile
- IP stack with TCP and UDP protocol
- E-Call compliant
- Embedded GPS/Glonass
- Rx Diversity
- Dimensions: 34 x 40 x 2.8 mm
- Weight: 9 grams
- Extended temperature range

  -40°C to +85°C (Extended operating range)

  -40°C to +90°C (Storage temperature)
- RoHS compliant
- Manufactured under TS16949 Quality specifications

Interfaces

- 10 I/O ports
- Digital voice support
- Analog voice support
- 2 ADC
- 1 DAC
- USB 2.0 High Speed
- 2 UART

Audio

- Telephony
- Half rate, full rate, enhanced full rate and adaptive multi rate voice codecs (HR, FR, EFR, AMR, WB-AMR)
- Superior echo cancellation & noise reduction

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

- DTMF

SMS

- Point-to-point mobile originated and mobile terminated SMS
- Concatenated SMS supported
- SMS cell broadcast
- Text and PDU mode
- SMS over GPRS

GSM Supplementary Services

- Call forwarding
- Call barring
- Call waiting & call hold
- Advice of charge
- Calling line identification presentation (CLIP)
- Calling line identification restriction (CLIR)
- Unstructured supplementary services mobile originated data (USSD)
- Closed user group

2.4.2. LE920-EUG Product Features

- 3GPP protocol stack release 9 compliant
- Output power
  - Class 4 (2 W, 33 dBm) @ GSM 850 / 900
  - Class 1 (1 W, 30 dBm) @ GSM 1800 / 1900
  - Class E2 (0.5 W, 27 dBm) @ EDGE 850 / 900
  - Class E2 (0.4 W, 26 dBm) @ EDGE 1800 / 1900
  - Class 3 (0.25 W, 24 dBm) @ UMTS
  - Class 3 (0.2 W, 23 dBm) @ LTE

Data transmission

- LTE:
  - DL up to 100.0Mbps

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

- UL up to 50Mbps

- HSPA-DC:
  - DL up to 42.0Mbps
  - UL up to 5.76Mbps
- WCDMA: up to 384kbps downlink/uplink
- EDGE: DL up to 293 kbps, UL up to 236.8 kbps
- GPRS: DL up to 100 kbps, UL up to 80 kbps
- Asynchronous non-transparent CSD up to 9.6kbps

GPRS data

- EDGE Class 33
- Mobile station class B
- Coding scheme 1 to 4 (GPRS) & Modulation Coding scheme 1 to 9 (EDGE)
- PBCCH support
- GERAN Feature Package 1 support (NACC, Extended TBF)

Approvals

- Fully type approved conforming with R&TTE directive
- CE, GCF

2.4.3. LE920-NAG Product Features

- 3GPP protocol stack release 9 compliant
- Output power
  - Class 4 (2 W, 33 dBm) @ GSM 850 / 900
  - Class 1 (1 W, 30 dBm) @ GSM 1800 / 1900
  - Class E2 (0.5 W, 27 dBm) @ EDGE 850 / 900
  - Class E2 (0.4 W, 26 dBm) @ EDGE 1800 / 1900
  - Class 3 (0.25 W, 24 dBm) @ UMTS
  - Class 3 (0.2 W, 23 dBm) @ LTE

Data transmission

- LTE:
  - DL up to 100.0Mbps
  - UL up to 50Mbps

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

- HSPA-DC:
  - DL up to 42.0Mbps
  - UL up to 5.76Mbps
- WCDMA: up to 384kbps downlink/uplink
- EDGE: DL up to 236.8 kbps, UL up to 118.4 kbps
- GPRS: DL up to 80 kbps, UL up to 40 kbps
- Asynchronous non-transparent CSD up to 9.6kbps

GPRS data

- EDGE Class 10
- Mobile station class B
- Coding scheme 1 to 4 (GPRS) & Modulation Coding scheme 1 to 9 (EDGE)
- PBCCH support
- GERAN Feature Package 1 support (NACC, Extended TBF)

Approvals

- Fully type approved conforming with R&TTE directive
- FCC, PTCRB, IC
- AT&T

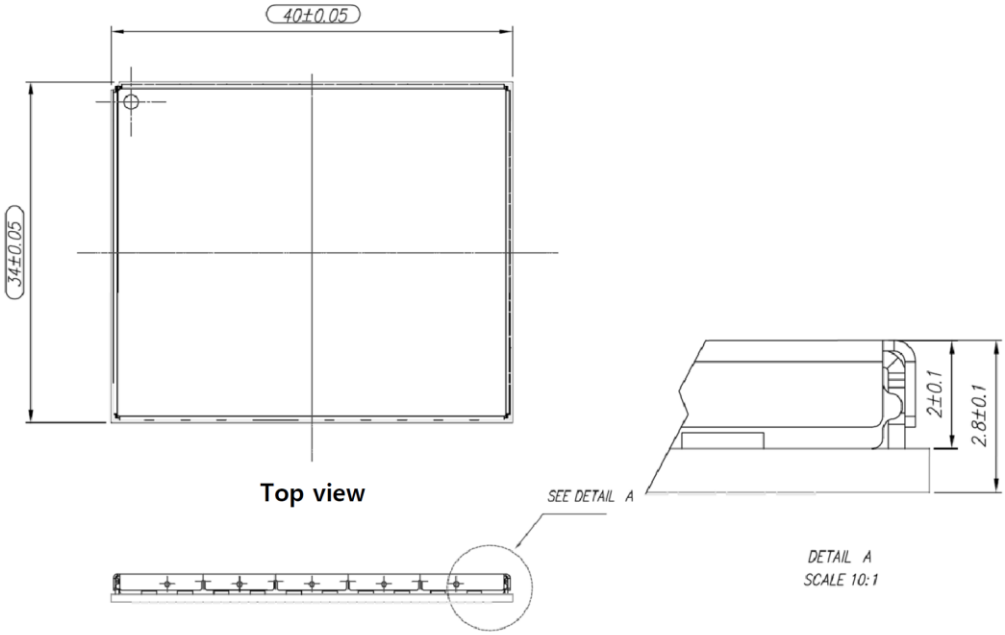
Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

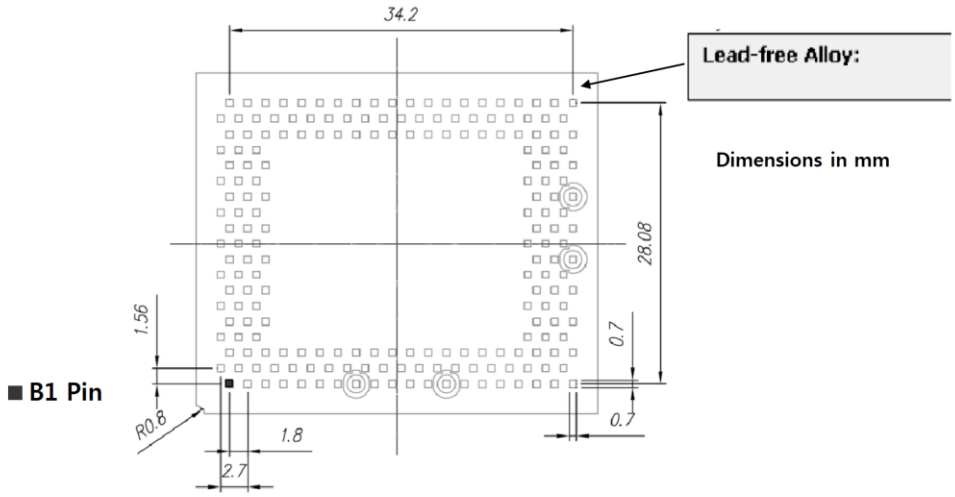
3. Product Description

3.1. Size and 2D mechanical drawing

The LE920 overall dimensions are:

- Length: 34 mm
- Width: 40 mm
- Thickness: 2.9 mm





3.2. Weight

The weight of the LE920 is about 9 grams.

3.3. Environmental requirements

3.3.1. Temperature range

		Note
Operating Temperature Range	–20°C ~ +55°C	The module is fully functional (*) in all the temperature range, and it fully meets the ETSI specifications.
	–40°C ~ +85°C	The module is fully functional (*) in all the temperature range. Temperatures outside of the range –20°C ÷ +55°C might slightly deviate from ETSI specifications.
Storage and non-operating Temperature Range	–40°C ~ +90°C	

(*)Functional: the module is able to make and receive voice calls, data calls, SMS and make GPRS traffic.

3.3.2. RoHS compliance

As a part of Telit's corporate policy of environmental protection, the LE920 product comply to the RoHS (Restriction of Hazardous Substances) directive of the European Union (EU Directive 2002/95/EG).

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.4. Operating Frequency

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

All LTE bands are LTE FDD

3.4.1. LE920-EUG

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels	TX - RX offset
GSM850	824 ~ 849	869 ~ 894	128 ~ 251	45 MHz
EGSM900	890 ~ 915	935 ~ 960	0 ~ 124	45 MHz
	880 ~ 890	925 ~ 935	975 ~ 1023	45 MHz
DCS1800	1710 ~ 1785	1805 ~ 1880	512 ~ 885	95MHz
PCS1900	1850 ~ 1910	1930 ~ 1990	512 ~ 810	80MHz
WCDMA2100 – B1	1920 ~ 1980	2110 ~ 2170	Tx: 9612 ~ 9888 Rx: 10562 ~ 10838	190MHz
WCDMA1800 – B3	1710 ~ 1785	1805 ~ 1880	Tx: 937 ~ 1288 Rx: 1162 ~ 1513	95MHz
WCDMA900 – B8	880 ~ 915	925 ~ 960	Tx: 2712 ~ 2863 Rx: 2937 ~ 3088	45MHz
LTE2100 – B1	1920 ~ 1980	2110 ~ 2170	Tx: 18000 ~ 18599 Rx: 0 ~ 599	190MHz
LTE1800 – B3	1710 ~ 1785	1805 ~ 1880	Tx: 19200 ~ 19949 Rx: 1200 ~ 1949	95MHz
LTE2600 – B7	2500 ~ 2570	2620 ~ 2690	Tx: 20750 ~ 21449 Rx: 2750 ~ 3449	120MHz
LTE900 – B8	880 ~ 915	925 ~ 960	Tx: 21450 ~ 21799 Rx: 3450 ~ 3799	45MHz
LTE800 – B20	832 ~ 862	791 ~ 821	Tx: 24150 ~ 24449 Rx: 6150 ~ 6449	-41MHz

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.4.2. LE920-NAG

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels	TX - RX offset
GSM850	824 ~ 849	869 ~ 894	128 ~ 251	45 MHz
EGSM900	890 ~ 915	935 ~ 960	0 ~ 124	45 MHz
	880 ~ 890	925 ~ 935	975 ~ 1023	45 MHz
DCS1800	1710 ~ 1785	1805 ~ 1880	512 ~ 885	95MHz
PCS1900	1850 ~ 1910	1930 ~ 1990	512 ~ 810	80MHz
WCDMA2100 – B1	1920 ~ 1980	2110 ~ 2170	Tx: 9612 ~ 9888 Rx: 10562 ~ 10838	190MHz
WCDMA1900 – B2	1850 ~ 1910	1930 ~ 1990	Tx: 9262 ~ 9538 Rx: 9662 ~ 9938	80MHz
WCDMAE1700 – B4	1710~ 1755	2110 ~ 2155	Tx: 19950 ~ 20399 Rx: 1950 ~ 2399	400MHz
WCDMA850 – B5	824 ~ 849	869 ~ 894	Tx: 4132 ~ 4233 Rx: 4357 ~ 4458	45MHz
WCDMA800 – B6	830 ~ 840	875 ~ 885	Tx: 4162 ~ 4188 Rx: 4387 ~4413	45MHz
LTE2100 – B1	1920 ~ 1980	2110 ~ 2170	Tx: 18000 ~ 18599 Rx: 0 ~ 599	190MHz
LTE1900 – B2	1850 ~ 1910	1930 ~ 1990	Tx: 18600 ~ 19199 Rx: 600 ~ 1199	80MHz
LTE1700 – B4	1710~ 1755	2110 ~ 2155	Tx: 19950 ~ 20399 Rx: 1950 ~ 2399	400MHz
LTE850 – B5	824 ~ 849	869 ~ 894	Tx: 20400 ~ 20649 Rx: 2400 ~ 2649	45MHz
LTE700 – B17	704 ~ 716	734 ~ 746	Tx: 23730 ~ 23849	30MHz

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

			Rx: 5730 ~ 5849	

3.5. Transmitter output power

The LE920 family transceiver output of GSM/GPRS mode in 850/900MHz bands are class 4 in accordance with the specifications which determine the nominal 2W peak RF power (+33dBm) on 50ohm. In the 1800/1900MHz bands are class 1 in accordance with the specification which determines the nominal 1W peak RF power (+30dBm) on 50ohm.

The LE920 family transceiver output of EDGE mode in 850/900MHz bands are class E2 in accordance with the specifications which determine the nominal 0.5W peak RF power (+27dBm) on 50ohm. In the 1800/1900MHz bands are class E2 in accordance with the specification which determine the nominal 0.4W peak RF power (+26dBm) on 50ohm.

The LE920 family transceiver output of WCDMA mode in NA model: 850/1700/1900/2100MHz & EU model: 900/1800/2100MHz bands is class 3 in accordance with the specifications which determine the nominal 0.25W peak RF power (+24dBm) on 50ohm.

The LE920 family transceiver output of LTE mode in NAG model: 700(B17)/850/1700/1900/2100MHz & EUG model: 800(B20)/900/2600(B7)/1800/2100MHz bands is class 3 in accordance with the specifications which determine the nominal 0.2W peak RF power (+23dBm) on 50ohm.

3.6. Antenna

The antenna connection and board layout design are the most important parts in the full product design and they strongly reflect on the product's overall performances. Read carefully and follow the requirements described in the Hardware User Guide.

3.7. Supply voltage

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

Nominal Supply Voltage	3.8 V
Normal Operating Voltage Range	3.3 V – 4.2 V

(*) Please refer to the LE920 Hardware User Guide for using the product with the extended operating voltage range.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.8. Power consumption (preliminary)

LE920 current consumption			
Mode		**Average(mA)**	**Mode Description**
SWITCHED OFF			Module supplied but switched Off
Switched Off		40 uA	
IDLE mode			Standby mode; no call in progress
AT+CFUN=1	WCDMA	16	Normal mode; Registered: full functionality of the module
	GSM	16	
	LTE	16	
AT+CFUN=4		10	Disabled TX and RX; modules is not registered on the network
AT+CFUN=5	WCDMA	1.7	DRx9
	GSM	1.9	
Operative mode (LTE)			
LTE (0dBm)		203	LTE data call channel BW 5MHz,RB=1, TX = 0dBm)
LTE (22dBm)		540	LTE data call (channel BW 5MHz,RB=1, TX = 22dBm)
Operative mode (WCDMA)			
WCDMA Voice		185	WCDMA voice call (TX = 10dBm)
WCDMA HSDPA (0dBm)		100	WCDMA data call (RMC, TX = 0dBm)
WCDMA HSDPA (22dBm)		390	WCDMA data call (RMC, TX = 22dBm)
Operative mode (GSM)			
GSM TX and RX mode			
GSM900 PL5		290	GSM Voice Call
DCS1800 PL0		170	
GPRS 4TX + 1RX			
GSM900 PL5		410	GPRS Sending data mode
DCS1800 PL0		320	
EDGE 4TX + 1RX			
GSM900 PL5		255	EDGE Sending data mode
DCS1800 PL0		240	

3.9. The user interface

The user interface is managed by AT commands according to ITU-T V.250, 3GPP 27.007 and 27.005 specifications. Moreover, custom AT commands are also available. Please refer to the AT Command User Guide for details.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.10. Inputs and Outputs

3.10.1. General Purpose I/Os

10 pins of general purpose I/Os can be configured by AT command in three different ways as input, output and alternative function.

3.10.2. Power on monitor (PWR_MON)

The PWR_MON indicates the status of the module running properly.

3.10.3. Power on/off control (ON_OFF)

External power on/off control input. Refer to the LE920 Hardware User Guide for more details of Power on timing.

3.10.4. Auxiliary power output for accessory (VAUX)

A regulated 1.8V power output is provided for an external device.

3.10.5. SIM Reader

The LE920 family supports 2 SIM/USIM at 1.8V and 3V ONLY with an external SIM connector. For 5V SIM, an external level translator can be added. Refer to the LE920 Hardware User Guide.

3.10.6. Serial Ports

Two serial ports are available on the module:

- Main serial port (full RS232), up to 115,200 bps
- AUX serial port (RX & TX only), 115,200 bps

3.10.7. USB port

The USB2.0 High Speed has a clock rate of 480MHz and a total gross throughput of 480Mbps. The net throughput is shared on a best-effort basis by all the exposed USB interfaces.

Below is an indication of how the module with default port settings could be visible in the Device Manager of your host Operating System. The information is entirely non-binding since every label can be modified by the software system designer and every port number is allocated automatically by your system – however the ascending order should be maintained as shown, thus “COM1” means the first free port in your system. It may also be possible to change the port configuration by AT command, so a final application may appear very different.

Telit assists in choosing the appropriate USB Device Drivers according to your operating system requirements, but cannot provide those drivers for every operating system. Detail information about configuring Device Drivers for Linux is available in document 1vv0300804.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

PID	VID	USB interface	Function	Windows	Linux	Android	QNX
0x1bc7	0x1201	-	Android Composite	ADB Interface	-	ADB Interface	-
		1	Diagnostic port	COM1	/dev/ttyUSB0	/dev/ttyUSB0	/dev/serusb0 */**
		2	NMEA port	COM2	/dev/ttyUSB1	/dev/ttyUSB1	/dev/serusb1 */**
		3	Modem port 1	COM3	/dev/ttyUSB2	/dev/ttyUSB3	/dev/serusb2 */**
		4	Modem port 2	COM4	/dev/ttyUSB3	/dev/ttyUSB3	/dev/serusb3 */**
		5	Remote SIM Access	COM5	/dev/ttyUSB4	/dev/ttyUSB4	/dev/serusb4 */**
		6	Ethernet Adapter	WWAN Adapter#1	/dev/cdc-wdm0 **	/dev/cdc-wdm0 **	/dev/eth0 **

*=or similar name, **=proprietary interface

3.11. Converters

3.11.1. ADC Converter

The LE920 has two on board ADC, which are 8-bit converters. It is able to read a voltage level in the range of 0÷2 volts applied on the ADC pin input, store and convert it into 8 bit word.

3.11.2. DAC Converter

The LE920 module provides a Digital to Analog Converter.

The on board DAC is in the range from 0 to 1023.

Note: an **external** low-pass filter is necessary. (Refer to the LE920 Hardware User Guide for more details).

3.12. Logic level specifications

Where not specifically stated, all the interface circuits work at 1.8V CMOS logic levels. To get more detailed information about the logic level specifications used in the LE920, please check with the Hardware User Guide.

3.13. Audio

3.13.1. Analog

The LE920 has in internal codec to provide an analog voice interface.

For more details, please refer to the LE920 Hardware User Guide.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

3.13.2. Digital

The LE920 offers the digital voice interface. For more details, please refer to the Digital Voice Interface Application Note.

3.14. Other features

3.14.1. Speech CODEC

The LE920 supports the following voice codec:

- HR – Half Rate
- FR – Full Rate
- EFR – Enhanced Full Rate
- AMR-HR, AMR Half Rate
- AMR-FR, AMR Full Rate
- WB-AMR, Wide band AMR

3.14.2. SMS

The LE920 supports the following SMS types:

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

The LE920 also supports SMS over GPRS

3.14.3. Phonebook

This function allows the storing of the telephone numbers in SIM memory. The capability depends on SIM version and its embedded memory.

3.14.4. Call status indication

The call status indication is supported.

3.15. Mounting the LE920 on your Board

The Telit LE920 module has been designed in order to be compliant with a standard lead-free SMT process. For detailed information about PCB pad design and conditions to use in SMT process please check with the LE920 Hardware User Guide.

3.16. Packing system

According to SMT process, for picking & placing movement requirements, LE920 family is packaged on trays.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

The level of moisture sensibility of LE920 family is “3”, according with standard IPC/JEDEC J-STD-020, take care of all the relative requirements for using this kind of components.
Special care for handling is highly required.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

4. Evaluation Kit

In order to assist the customer in the development of the application, Telit offers the EVK2 Evaluation Kit that can be ordered separately. The EVK2 has a SIM card holder, the RS 232 serial port level translator, a direct UART connection, audio and antenna connector.

The EVK2 provides a fully functional solution for a complete data or phone application. The standard serial RS232 9 pin connector placed on the Evaluation Kit allows the connection of the EVK2 system with a PC or other DTE.

The development of the applications utilizing the Telit LE920 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 EVK2 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.

For a detailed description of the Telit Evaluation Kit, please refer to the documentation provided with the Telit LE920 Hardware User Guide and EVK2 User Manual.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

4.1. AT Commands

The Telit LE920 module can be driven via the serial and USB interface using the standard AT commands .

The module is compliant with:

1. Hayes standard AT command set, in order to maintain the compatibility with existing SW programs.
2. 3GPP 27.007 specific AT command and GPRS specific commands.
3. 3GPP 27.005 specific AT commands for SMS (Short Message Service) and CBS (Cell Broadcast Service)

Moreover the LE920 module supports also Telit proprietary AT commands for special purposes.

For a more information about AT commands supported by the LE920 module please refer to document AT Commands Reference Guide.

4.2. 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 must 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 the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any indication of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for the correct wiring of the product. The product must be supplied with a stabilized voltage source and the wiring must conform to the security and fire prevention regulations. The product must be handled with care, avoiding any contact with the pins since electrostatic discharges may damage the product itself. The same caution must to be taken for the SIM, checking carefully the instructions for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product; therefore, care must be taken in selecting the external components of the module, as well as for any project or installation issue, due to the risk of disturbing the GSM network or external devices or having impact on safety. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module must be equipped with a proper antenna with specific characteristics. The antenna must 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 this requirement cannot be satisfied, the system integrator must assess the final product against the SAR regulation.

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

The European Community provides some Directives for all electronic equipment introduced in to the market. All relevant information is available on the European Community website:

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

There the text of the Directive 99/05 regarding telecommunication equipment is available, whereas the applicable Directives for Low Voltage and EMC are available at:

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

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

5. List of acronyms

ACM	Accumulated Call Meter
AMR	Adaptive Multi Rate
ASCII	American Standard Code for Information Interchange
AT	Attention commands
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
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
FDD	Frequency Division Duplexing
FTA	Full Type Approval (ETSI)
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	International 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
OEM	Other Equipment Manufacturer
PB	Phone Book
PDU	Protocol Data Unit
PH	Packet Handler

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

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
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
UDUB	User Determined User Busy
USSD	Unstructured Supplementary Service Data

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.

6. Document History

Revision	Date	Changes
0	2012-10-18	First issue
1	2013-09-02	Updated Chapter 2.1, 2.3, 2.4, 3.7, 3.8
2	2013-11-29	Changes to Chapter 2.1, 3.4, 4.2, 5
3	2014-08-13	Updated 2.3/ 2.4.1/ 2.4.3/ 3.4.1/ 3.4.2/ 3.10.7/ 3.14.1

Reproduction forbidden without written authorization from Telit Communications S.p.A. - All Rights Reserved.