ZE51/61-2.4 and XE61-2.4 RF Module User Guide

1vv0300868 Rev.10 – 2015-03-19

Making machines talk.

APPLICABILITY TABLE

PRODUCT
XE61-2.4
ZE51-2.4
ZE61-2.4

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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Contents

1. Introduction

1.1. Scope

Scope of this document is to present the features and the application of the ZE51-2.4, ZE61-2.4 RF and XE61-2.4RF modules.

1.2. Audience

This document is intended for developers and integrators using Telit ZE51-2.4, ZE61-2.4 and XE61-2.4 Modules.

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-SRD@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: "General Requirement" gives an overview of the limitations imposed by Reference standards.

"Chapter 3: "General Characteristics" describes in details the characteristics of the product.

"Chapter 4: "Technical Description" describes in details the signals and pin-out of the product.

"Chapter 5: "Process information" describes in details the delivery, storage, soldering and placement of the product.

"Chapter 6: "Board Mounting Recommendations" describes in details the interface and coupling of the product.

"Chapter 7: "Antenna Considerations" describe examples of propagation attenuation.

"Chapter 8: "Annexes" Contains NBO, Certificates and Conformity Assessment.

"Chapter 9: "Glossary" shows acronyms used in the document..

"Chapter 10: "Document history" describes the revision history of the 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] IEEE Std. 802.15.4-2006 Wireless MAC and PHY Specifications for Low Rate - WPANs
- [2] ERC Rec 70-03 ERC Recommendation for SRD, October 2010
- [3] EN 300 328-1 V1.7.1 (Europe) ETSI Standards for SRD , October 2006
- [4] EN 300 440-1 V1.6.1 (Europe) ETSI Standards for SRD , August 2010
- [5] 2002/95/EC Directive of the European Parliament and of the Council, 27 January 2003
- [6] CFR47 Part 15 (US) FCC Standards for SRD
- [7] ARIB STD-T66 (Japan) ARIB Standards for SRD
- [8] Z-One Pro Protocol Stack User Guide 1vv0300902
- [9] 2006/771/EC Harmonization of the radio spectrum for use by short-range devices
- [10] 2009/381/EC Amending Decision 2006/771/EC on harmonization of the radio spectrum for use by short-range devices
- [11] SR Manager Tool User Guide 1vv0300899
- [12] ZigBee PRO Democase Getting Started 1vv0300901
- [13] ZigBee PRO Democase User Guide1vv0300900

2. General Requirements

2.1. Regulations requirements

The ZE51/61-2.4 or XE61-2.4 module is a [1],[2],[6],[7] compliant multi-channel radio modem in the 2.4GHz band (unlicensed frequency band).

2.1.1. Europe Regulation:

The "ERC recommendation 70-03" [2] describes the limits band in the 2.4GHz license free band, in terms of bandwidth, maximum power, duty cycle, channel spacing and type of application. It gives the following limitations:

Class	Frequency band	Maximum radiated power	Channel spacing	Duty cycle	Notes
Annex 1h (Non-Specific Short range Devices)	2400 – 2483.5 MHz	10 mW e.i.r.p.	No channel spacing specified	No restriction	
Annex 3a (Wideband Data Transmission systems)	2400 – 2483.5 MHz	100 mW e.i.r.p. and 100 mW/100 kHz e.i.r.p. density applies when frequency hopping modulation is used, 10 mW/MHz e.i.r.p. density applies when other types of modulation are used.(*)(**)	No channel spacing specified.	No restriction	For wide band modulations other than FHSS, the maximum e.i.r.p. density is limited to 10 mW/MHz

(*) Compliant to the EU Commission Decision [9], [10]. Techniques to access spectrum and mitigate interference that provide at least equivalent performance to the techniques described in harmonized standards adopted under Directive 1999/5/EC must be used.

(**) For IEEE802.15.4 DSSS modulation used by ZigBee, the modulated signal is spread over 2MHz. So, the maximum radiated power is 20mW. The output power must therefore be reduced to approximately +13 dBm in order to get CE approval. The final output power level will depend on the antenna used.

2.1.2. Restrictions for non specific SR devices Annex 1h 2400-2483.5MHz:

Country	Restriction	Reason/Remark
Norway	Implemented	This subsection does not apply for the geographical area within a radius of 20 km from the centre of Ny-Ålesund
Russian Federation		Bluetooth
Ukraine	Limited implementation	e.i.r.p. ≤100 mW

2.1.3. Restrictions for Wideband Data Transmission systems Annex 3a 2400-2483.5MHz:

Country	Restriction	Reason/Remark
France	Outdoor use limited to 10 mW e.i.r.p. within the band 2454-2483.5 MHz	Military Radiolocation use. Reforming of the 2.4 GHz band has been ongoing in recent years to allow current relaxed regulation. Full implementation planned 2012
Italy		For private use, a general authorisation is required if WAS/RLAN's are used outside own premises. For public use, a general authorization is required
Ukraine	Limited Implemented	e.i.r.p. ≤100 mW with built-in antenna with amplification factor up to 6 dBi
Norway	Implemented	This subsection does not apply for the geographical area within a radius of 20 km from the centre of Ny-Ålesund
Russian Federation		**1. SRD with FHSS modulation** 1.1. Maximum 2.5 mW e.i.r.p. 1.2. Maximum 100 mW e.i.r.p. Permitted for use SRD for outdoor applications without restriction on installation height only for purposes of gathering telemetry information for automated monitoring and resources accounting systems. Permitted to use SRD for other purposes for outdoor applications only when the installation height is not exceeding 10 m above the ground surface. 1.3.Maximum 100 mW e.i.r.p. Indoor applications **2. SRD with DSSS and other than FHSS wideband modulation** 2.1. Maximum mean e.i.r.p. density is 2 mW/MHz. Maximum 100 mW e.i.r.p. 2.2. Maximum mean e.i.r.p. density is 20 mW/MHz. Maximum 100 mW e.i.r.p. Permitted to use SRD for outdoor applications only for purposes of gathering telemetry information for automated monitoring and resources accounting systems or security systems. 2.3. Maximum mean e.i.r.p. density is 10 mW/MHz. Maximum 100 mW e.i.r.p. Indoor applications

For the complete document please refer to [2] and EU Commission Decision [9], [10].

The 2.4 Ghz band is a harmonized band in most of Europe. So the product must be declared in compliance with the harmonized ETSI standards EN 300 440 (Class 1h) or EN 300 228 (Class 3a).

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

2.1.4. USA Regulation:

In the United States the FCC is responsible for the regulation of all RF devices. Our module intended for unlicensed operation is regulated by CFR 47, Part 15 [6].

The 2.4 GHz band used for unlicensed radio equipment is regulated by section 15.247.

2.1.5. Japan regulation

In Japan the unlicensed use of short range devices in the 2.4 GHz ISM band is regulated by the ARIB standard STD-T66 [7].

2.2. Functional Requirements

The ZE51/61-2.4 or XE61-2.4RF module is a complete solution from serial interface to RF interface. The ZE51/61-2.4 or XE61-2.4 module has a digital part and a RF part.

The digital part has the following functionalities:

- Communication interface
- I/O management
- Micro controller with embedded software

The RF part has the following functionalities:

- 2.4 GHz IEEE 802.15.4 compliant RF transceiver
- Half Duplex bi-directional link
- RF front-end component with low noise Rx amplification and Tx power amplification (XE/ZE61-2.4 module only)

2.3. Software

The ZE51/61-2.4 or XE61-2.4 module is provided pre-flashed with Telit in-house ZigBee® PRO stack. Please refer to ZigBee PRO Protocol Stack User Guide [8] for detail information.

In case the customer needs to develop his own software, different tools are available:

- 8051 compiler from IAR : http://www.iar.se/website1/1.0.1.0/244/1/
- CC debugger: http://focus.ti.com/docs/toolsw/folders/print/cc-debugger.html

The technical support for these tools will be done by the providing company.

All necessary drivers for ZE51-2.4 Usb dongle can be found under the following link:

http://www.ftdichip.com/Drivers/VCP.htm

A complete correspondence table of the connections between the CC2530 and the pin out of the module, as well as the connections to the included STM M24C64 EEPROM can be found in chapter IV.3.

- In case, the customer wants to test the RF performances of the module, Telit can provide its own proprietary test software that is available in the download zone together with description of all the functionalities.

2.4. Temperature Requirements

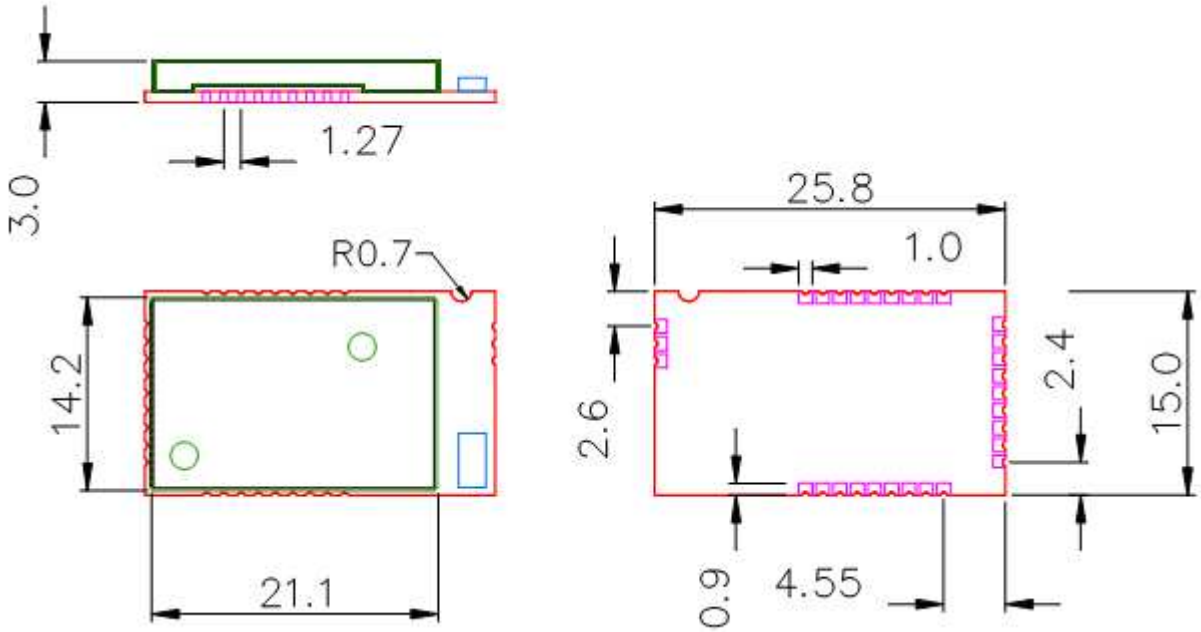
	Minimum	Typical	Maximum	Unit
Operating				
Temperature	- 40	25	+ 85	°C
Relative humidity @ 25°C	20		75	%
Storage				
Temperature	- 40	25	+ 85	°C

3. General characteristics

3.1. Mechanical Characteristics

Size :	Rectangular 26 x 15 mm
Height :	3 mm
Weight :	1,7 g
PCB thickness:	0.8 mm
Cover :	• Dimensions : 21 x 14 x 2.2mm • Thickness : 200µm
Components :	All SMD components, on one side of the PCB.
Connectors :	The terminals allowing conveying I/O signals are half-moons located around.
Mounting :	• SMD • Half moons on the 4 external sides
Number of pins :	30

3.2. Mechanical dimensions



3.3. DC Characteristics

Measured on ZE51/61-2.4/DIP,and XE61-2.4/DIP interfaces with T = 25°C, Vdd = 3V, 50 ohm impedance if nothing else noted.

Max limits apply over the entire operating range, T=-40°C to +85°C, Vdd=2V to 3.6V and all channels.

Characteristics ZE51	Min.	Typ.	Max.
Power Supply (VDD):	+2.0V		+3.6V
Transmission :		35mA	39mA*
Reception :		26mA	29mA
Stand-by (32.768 khz On) :		2µA	2.7µA
Sleep (wake up on interruption) :		1µA	
I/O low level :	GND	-	0.9 V
I/O high level :	V_{DD} - 0.7V	-	V_{DD}
Characteristics ZE/XE61	**Min.**	**Typ.**	**Max.**
Power Supply (VDD):	+2.0V		+3.6V
Transmission :		160mA	195mA*
Reception :		31mA	33mA
Stand-by (32.768 khz On) :		2,2µA	2.9µA
Sleep (wake up on interruption) :		1,5µA	
I/O low level :	GND	-	0.9 V
I/O high level :	V_{DD} - 0.7V	-	V_{DD}

* : Maximum Tx consumption is reached for T= -40°C , Vdd=3.6 Volts and default power register setting. In this condition, the ZE/XE61 RF output power achieves until 21dBm.

3.4. Functional characteristics

Measured on ZE51/61-2.4/DIP and XE61-2.4/DIP interfaces with T = 25°C, Vdd = 3V, 50 ohm impedance if nothing else noted.

Global			
Frequency band	2400 - 2483.5 MHz		
Channel spacing	5 MHz		
Channel number	16 : Channel 11 (2405MHz) → Channel 26 (2480MHz)		
Technology	DSSS		
Modulation	O-QPSK with half sine pulse shaping		
Radio bit rate	250 kbps		
Transmit chip rate	2 Mchip/s		
Transmission ZE51	Min.	Typ.	Max.
Output Power	+4dBm ± 1 dB on the whole band (selectable by software)		
Harmonics 2nd harmonic 3rd harmonic		-45 dBm -59 dBm	
Spurious emission 30 - 1000 MHz 1 - 12.75 GHz 1.8 - 1.9 GHz 5.15 - 5.3 GHz			-36 dBm -30 dBm -47 dBm -47 dBm (Complies with [3], [4], [6],[7])
Error Vector Magnitude (EVM)		5%	15%
Transmission ZE/XE61	Min.	Typ.	Max.
Output Power*	+19dBm ± 1 dB on the whole band (selectable by software)		
Harmonics 2nd harmonic 3rd harmonic		-42 dBm -44 dBm	
Spurious emission 30 - 1000 MHz 1 - 12.75 GHz 1.8 - 1.9 GHz 5.15 - 5.3 GHz			-36 dBm -30 dBm -47 dBm -47 dBm (Complies with [3], [4], [6], [7])
Error Vector Magnitude (EVM)		5%	15%

*: It's the responsibility of Telit customers to check that RF output power of the final product is compliant with the local regulation. See

the table in chapter VIII.5 which shows the typical output power for different power settings.

Reception ZE51	Min.	Typ.	Max.
Sensitivity for PER=1%	-	-96 dBm	-97 dBm
Saturation for PER=1%	-	10 dBm	-
Adjacent channel rejection +/- 5 MHz channel spacing	-	49 dB	-
	Wanted signal @ -82 dBm, adjacent modulated channel @ +/- 5 MHz, for PER = 1 %.		
Alternate channel rejection +/- 10 MHz channel spacing	-	54 dB	-
	Wanted signal @ -82 dBm, adjacent modulated channel @ +/- 10 MHz, for PER = 1 %.		
Blocking/Desensitisation @ ±5MHz @ ±10MHz @±20MHz @±50MHz	 - - - -	 - 40 dBm - 35 dBm - 38 dBm - 37 dBm	 - - - -
	Wanted signal 3 dB above the sensitivity level, CW jammer, for PER = 1%. (Measured according to EN 300 440 class 2)		
Spurious emission in 30 MHz - 12.75 GHz	-	-	-47 dBm (Complies with [3], [4], [6],[7])

Reception ZE61/XE61	Min.	Typ.	Max.
Sensitivity for PER=1%	-	-99 dBm	-100dBm
Saturation for PER=1%	-	0 dBm	-
Adjacent channel rejection +/- 5 MHz channel spacing	-	49 dB	-
	Wanted signal @ -82 dBm, adjacent modulated channel @ +/- 5 MHz, for PER = 1 %.		
Alternate channel rejection +/- 10 MHz channel spacing	-	54 dB	-
	Wanted signal @ -82 dBm, adjacent modulated channel @ +/- 10 MHz, for PER = 1 %.		
Blocking/Desensitisation @ ±5MHz @ ±10MHz @±20MHz @±50MHz	 - - - -	 - 35 dBm - 35 dBm - 33 dBm - 35 dBm	 - - - -
	Wanted signal 3 dB above the sensitivity level, CW jammer, for PER = 1%. (Measured according to EN 300 440 class 2)		
Spurious emission in 30 MHz - 12.75 GHz	-	-	-47 dBm (Complies with [3], [4], [6],[7])

3.5. Digital Characteristics

Microcontroller	8051 core
Microcontroller Memory	256KB Flash, 8KB SRAM,
Peripheral memory	8 KB EEPROM
Serial link*	Managed by application. • Full Duplex, from 1200 to 115200 bps • 7 or 8 bits, with or without parity, 1 or 2 stop bits • Protocol Type : RS-232, TTL level
Flow control*	Managed by application. None, Software (Xon/Xoff) or Hardware (RTS/CTS)
Other	Ultra low power voltage detector and µC supervisory circuit
Specific signals	• Serial : Tx, Rx, RTS, CTS • Inputs : Reset, Stand-By, Prog • I/O : 7 I/O (among those 5 analog inputs with 7 to 12 bits resolution)
Flashing	• Through serial • Through the air : DOTA (Download Over The Air) functionality
Embedded functionality	• Point-to-point stack for test purpose available in download zone • ZigBee Pro stack from Telit

*: In ZigBee Democase : 115.200 bps,8 bits, without parity, 1 stop bit, No flow control

3.6. Absolute Maximum Ratings

ZE51	
Voltage applied to V_{DD}	-0.3V to +3.9V
Voltage applied to any digital pin	-0.3V to V_{DD}+0.3V, max 3.9 V
Input RF level	10 dBm
ZE61	
Voltage applied to V_{DD}	-0.3V to +3.6V
Voltage applied to any digital pin	-0.3V to V_{DD}+0.3V, max 3.6 V
Input RF level	0 dBm

It must be noted that due to some components, ZE51/ZE61/XE61 module is an ESD sensitive device. Therefore, ESD handling precautions should be carefully observed.

3.7. Ordering information

The following equipments can be ordered:

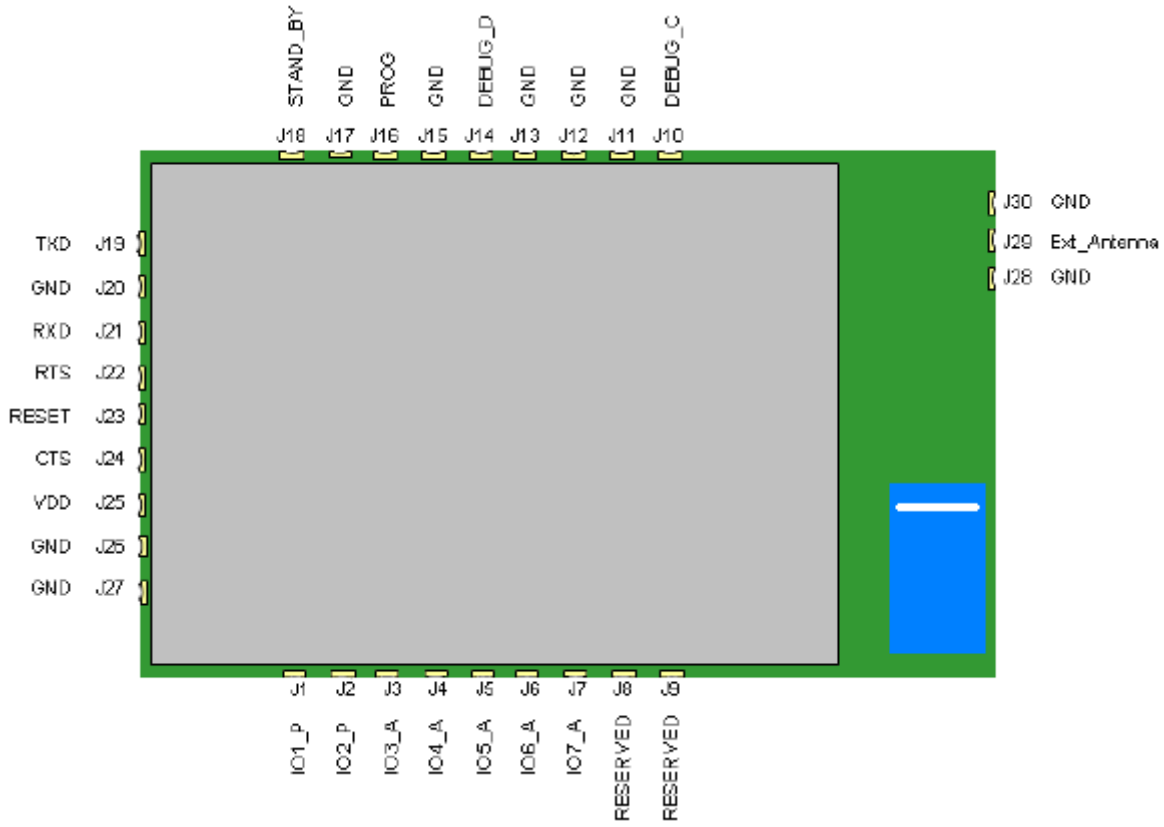
- The SMD version
- The DIP interface version
- The Demo Case composed by n.6 evaluation boards, n.6 DIP interface boards, n.2 I/O report interface, RF antennas, serial cables, power supplies / batteries.

The versions below are considered standard and should be readily available. For other versions, please contact Telit. Please make sure to give complete part numbers when ordering.

Equipment and Part Number	
SMD Version	
ZE/XE51/61-2.4/SMD-IA (With Integrated Antenna)	**ZE/XE51/61-2.4/SMD-WA** (Without Integrated Antenna)
	
DIP Version	
ZE/XE51/61-2.4/DIP-IA (With Integrated Antenna)	**ZE/XE51/61-2.4/DIP-WA (Without Integrated Antenna)**
	
Demo Case	
D XE/ZE51/61 DEMO	
	

4. Technical DESCRIPTION

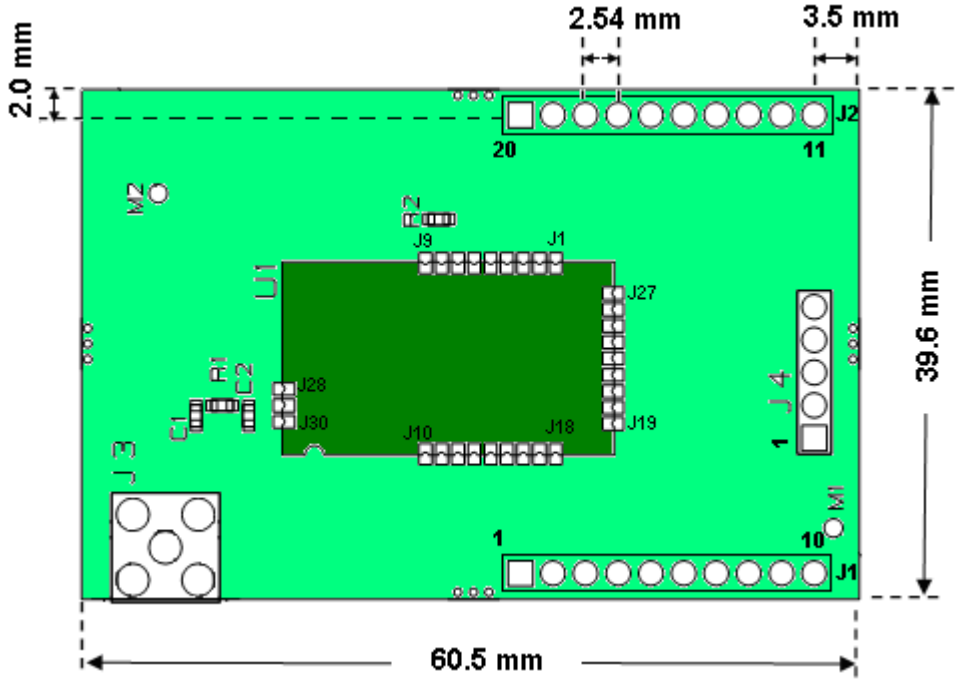
4.1. Pin-out of the SMD Module

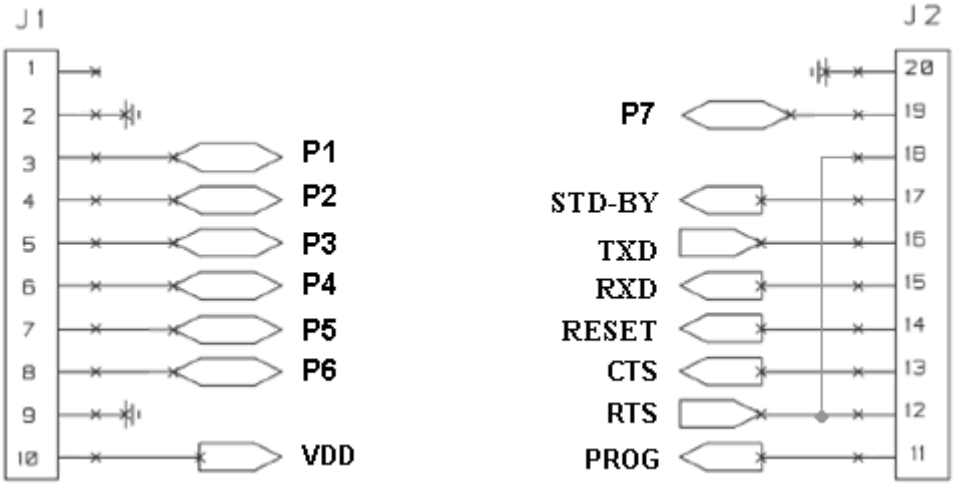


Pin	Pin name	Pin type	Signal level	Function
J30	GND	Gnd		RF Ground connection for external antenna
J29	Ext_Antenna	RF		RF I/O connection to external antenna
J28	GND	Gnd		RF Ground connection for external antenna
J27	GND	Gnd		Ground
J26	GND	Gnd		Ground
J25	VDD	Power		Digital and Radio part power supply pin
J24	CTS	I	TTL	Clear To Send
J23	RESET	I	TTL	µC reset (Active low with internal pull-up)
J22	RTS	O	TTL	Request To Send
J21	RXD	I	TTL	RxD UART – Serial Data Reception
J20	GND	Gnd		Ground
J19	TXD	O	TTL	TxD UART – Serial Data Transmission
J18	STAND_BY	I	TTL	Standby (Active high with internal pull-down)
J17	GND	Gnd		Ground
J16	PROG	I	TTL	Signal for serial µC flashing (Active high with internal pull-down)
J15	GND	Gnd		Ground
J14	DEBUG_D	I/O	TTL	Debug data.
J13	GND	Gnd		Ground
J12	GND	Gnd		Ground
J11	GND	Gnd		Ground
J10	DEBUG_C	I/O	TTL	Debug clock
J9	RESERVED	-	-	-
J8	RESERVED	-	-	-
J7	IO7_A	I/O	analog	ADC - Analog Input N°7 (Digital I/O capability)
J6	IO6_A	I/O	analog	ADC - Analog Input N°6 (Digital I/O capability)
J5	IO5_A	I/O	analog	ADC - Analog Input N°5 (Digital I/O capability)
J4	IO4_A	I/O	analog	ADC - Analog Input N°4 (Digital I/O capability)
J3	IO3_A	I/O	analog	ADC - Analog Input N°3 (Digital I/O capability)
J2	IO2_P	I/O	TTL	Digital I/O N°2 with 20mA sink/source capability
J1	IO1_P	I/O	TTL	Digital I/O N°1 with 20mA sink/source capability

Reserved pins must not be connected

4.2. DIP Module mechanical dimensions and pin-out





4.3. Pin-out correspondence table ZE51

Pin-Out correspondence between ZE51-2.4/DIP, ZE51-2.4/SMD and CC2530 SOC.

ZE51-2.4/DIP			ZE51-2.4/SMD		CC2530 SOC		Comments
Connector	Pin	Name	Pin	Pin Name	Pin	Pin Name	
J1	1						
	2			GND		GND	
	3	P1	J5	IO5_A	15	P0_4	
	4	P2	J9	IO9_I	38	P1_6	Reserved Pin
	5	P3	J2	IO2_P	9	P1_1	
	6	P4	J1	IO1_P	11	P1_0	
	7	P5	J4	IO4_A	16	P0_3	
	8	P6	J3	IO3_A	17	P0_2	
	9			GND		GND	
	10		J25	VDD		AVDD,DVDD	
J2	11		J16	PROG	36	P2_0	
	12		J22	RTS	7	P1_3	
	13		J24	CTS	8	P1_2	
	14		J23	Reset	20	Reset_N	
	15		J21	RxD	6	P1_4	
	16		J19	TxD	5	P1_5	
	17		J18	STAND_BY	37	P1_7	
	18		J22	RTS	7	P1_3	
	19	P7	J6	IO6_A	14	P0_5	
	20			GND		GND	
J4	1		J14	Debug D	35	P2_1	J4 Connector for debugging and flashing
	2		J10	Debug C	34	P2_2	
	3		J23	Reset	20	Reset_N	
	4		J25	VDD		AVDD,DVDD	
	5			GND		GND	
			J7	IO7_A	13	P0_6	
			J8	IO8_A	12	P0_7	Reserved Pin
RF connection							
J3	SMA connector		J29	Ext_Antenna (Unbalanced RF)			Concern the Without Integrated Antenna version. A 50 Ohm coplanar wave guide and a matching network connect J29 to J3

4.4. Pin-out correspondence table ZE/XE61

Pin-Out correspondence between ZE/XE61-2.4/DIP,ZE/XE61-2.4/SMD and CC2530 SOC.

ZE/XE61-2.4/DIP			ZE/XE61-2.4/SMD		CC2530 SOC		Comments
Connector	Pin	Name	Pin	Pin Name	Pin	Pin Name	
J1	1						
	2			GND		GND	
	3	P1	J5	IO5_A	15	P0_4	
	4	P2	J7	IO7_A	38	P1_6	Connection between IO7_A and P2 though R_2 =1KOhm implanted on DIP interface
	5	P3	J2	IO2_P	9	P1_1	
	6	P4	J1	IO1_P	11	P1_0	
	7	P5	J4	IO4_A	16	P0_3	
	8	P6	J3	IO3_A	17	P0_2	
	9			GND		GND	
	10		J25	VDD		AVDD,DVDD	
J2	11		J16	PROG	36	P2_0	
	12		J22	RTS	13	P0_6	
	13		J24	CTS	12	P0_7	
	14		J23	Reset	20	Reset_N	
	15		J21	RxD	6	P1_4	
	16		J19	TxD	5	P1_5	
	17		J18	STAND_BY	37	P1_7	
	18		J22	RTS	7	P1_3	
	19	P7	J6	IO6_A	14	P0_5	
	20			GND		GND	
J4	1		J14	Debug D	35	P2_1	J4 Connector for debugging and flashing
	2		J10	Debug C	34	P2_2	
	3		J23	Reset	20	Reset_N	
	4		J25	VDD		AVDD,DVDD	
	5			GND		GND	
			J8	IO8_A			Not internally connected
			J9	IO9_I			
					7	P1_3	PA control
					8	P1_2	LNA control

RF connection						
J3	SMA connector	J29	Ext_Antenna (Unbalanced RF)			Concern the Without Integrated Antenna version. A 50 Ohm coplanar wave guide and a matching network connect J29 to J3

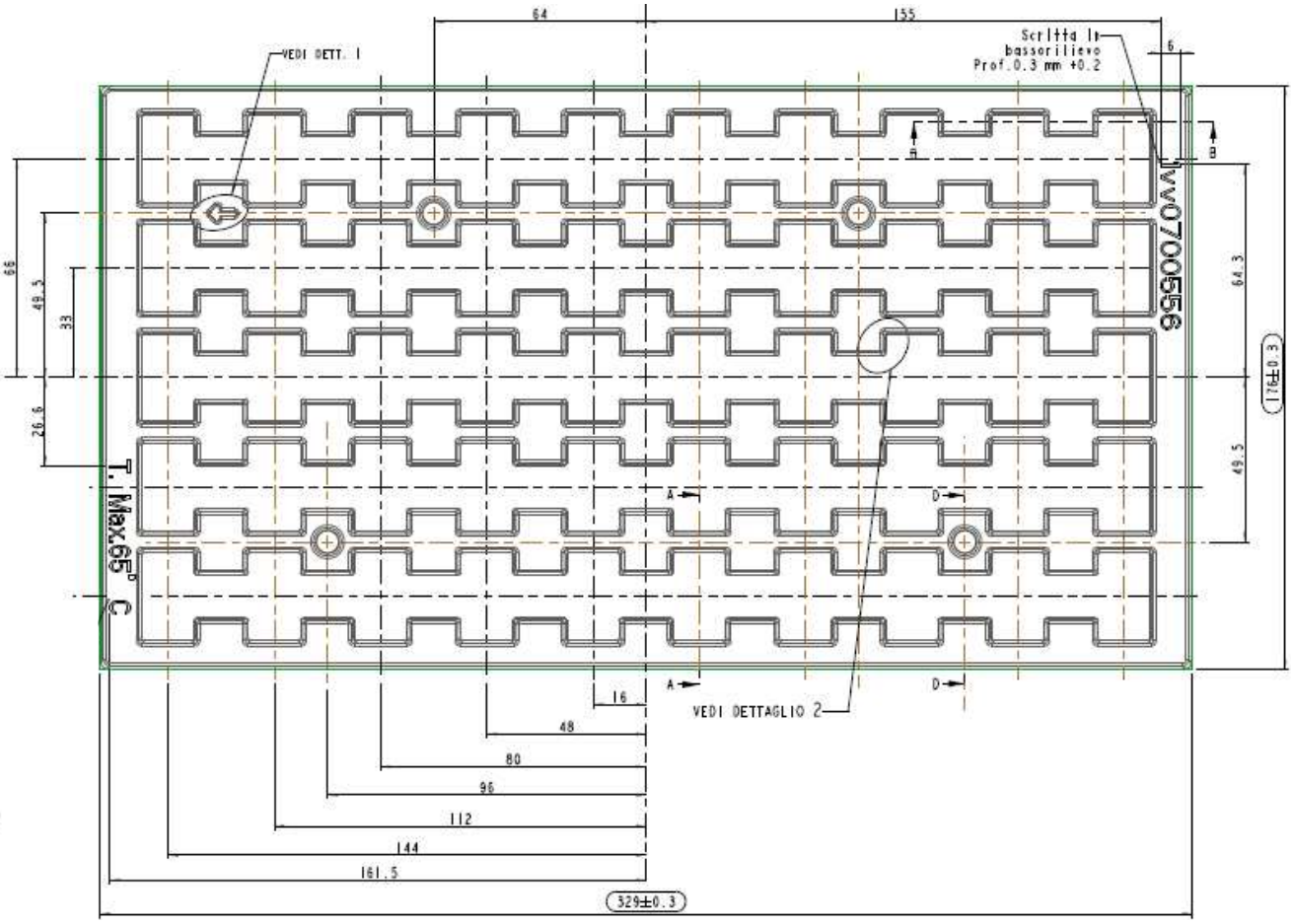
4.5. Description of the Signals

Signals	Description
Reset	External hardware reset of the radio module. Active on low state.
TXD, RXD	Serial link signals, format NRZ/TTL: TXD is for outgoing data. RXD is for incoming data. The '1' is represented by a high state.
CTS	Incoming signal. Indicates whether the module can send serial data to user (Active, on low state) or not (inactive, on high state).
RTS	Outgoing signal. Indicates whether the user can transmit serial data (active, on low state) or not (inactive, on high state).
IO	I/O, configurable as input or as output. (Available upon request only)
STAND_BY	Indicates to the module to switch to pre-selected low-power mode. (Available upon request)

5. Process information

5.1. Delivery

ZE/51/61-2.4/SMD and XE61-2.4/SMD modules are delivered in plastic tray packaging, each tray including 50 units. The dimensions of the tray are the following: 329 mm x 176 mm x 5.6 mm. Each unit is placed in a 26.6 mm x 16 mm location. An empty tray weights 45 g and a loaded tray weights around 130 g.



5.2. Storage

The optimal storage environment for ZE51/61-2.4/SMD and XE61-2.4/SMD modules should be dust free, dry and the temperature should be included between -40°C and +85°C.

5.3. Moisture sensibility

The level of moisture sensibility of the Product is “3” according with standard IPC/JEDEC JSTD-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 the Product inside of the dry bag must be 12 months from the bag seal date,
b) when stored in a non-condensing atmospheric environment of <= 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5
c) c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition b) “IPC/JEDEC J-STD-033A paragraph 5.2” is respected
d) d) Baking is required if conditions b) or c) are not respected
e) e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more

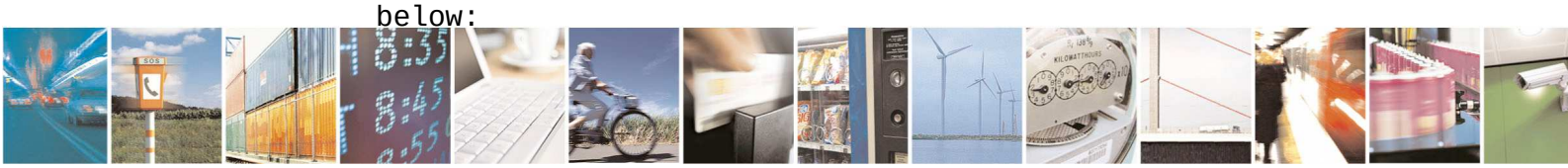
5.4. Additional Precautions

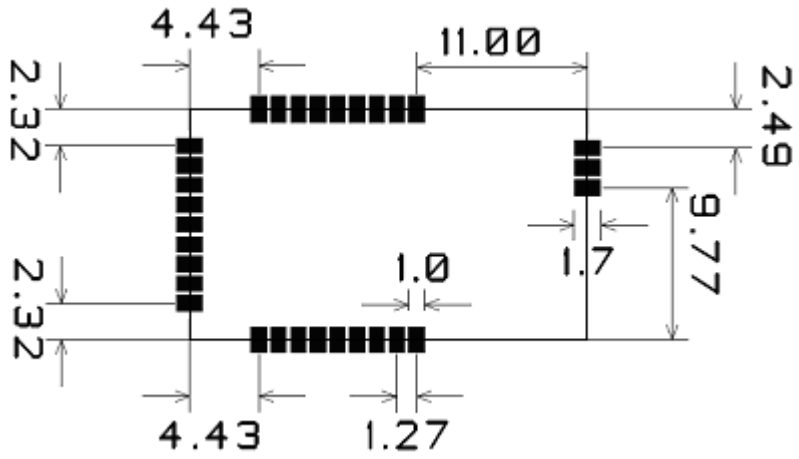
Also, it must be noted that due to some components, ZE51/61-2.4/SMD and XE61-2.4/SMD modules are ESD sensitive device. Therefore, ESD handling precautions should be carefully observed.

5.5. Soldering pad pattern

The surface finished on the printed circuit board pads should be made of Nickel/Gold surface.

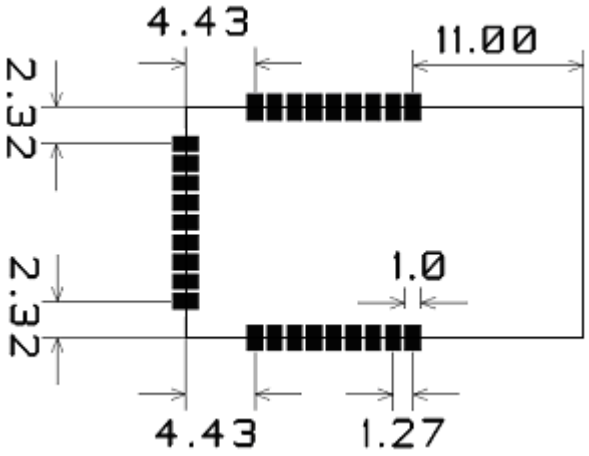
The recommended soldering pad layout on the host board for the ZE51/61-2.4/SMD-WA or XE61-2.4/SMD-WA is shown in the diagram below:





All dimensions in mm

The recommended soldering pad layout on the host board for the ZE51/61-2.4/SMD-IA or XE61-2.4/SND-IA, is shown in the diagram below:



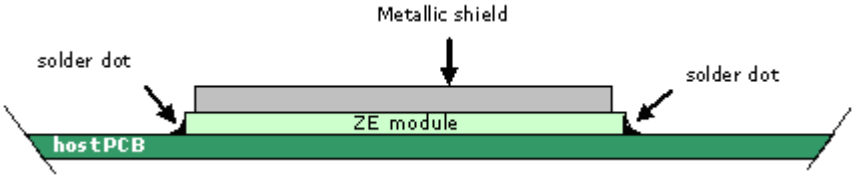
All dimensions in mm

Neither via-holes nor wires are allowed on the PCB upper layer in area occupied by the module.

5.6. Solder paste composition (RoHS process)

ZE51/61-2.4/SMD and XE61-2.4 modules are designed for surface mounting using half-moon solder joints (see diagram below). For proper module assembly, solder paste must be printed on the target surface of the host board. The solder paste should be eutectic and made of 95.5% of SN, 4% of Ag and 0.5% of Cu. The recommended solder paste height is 180 µm .

The following diagram shows mounting characteristics for tiny integration on host PCB:



5.7. Placement

The ZE51/61-2.4/SMD and XE61-2.4 modules can be automatically placed on host boards by pick-and-place machines like any integrated circuit.

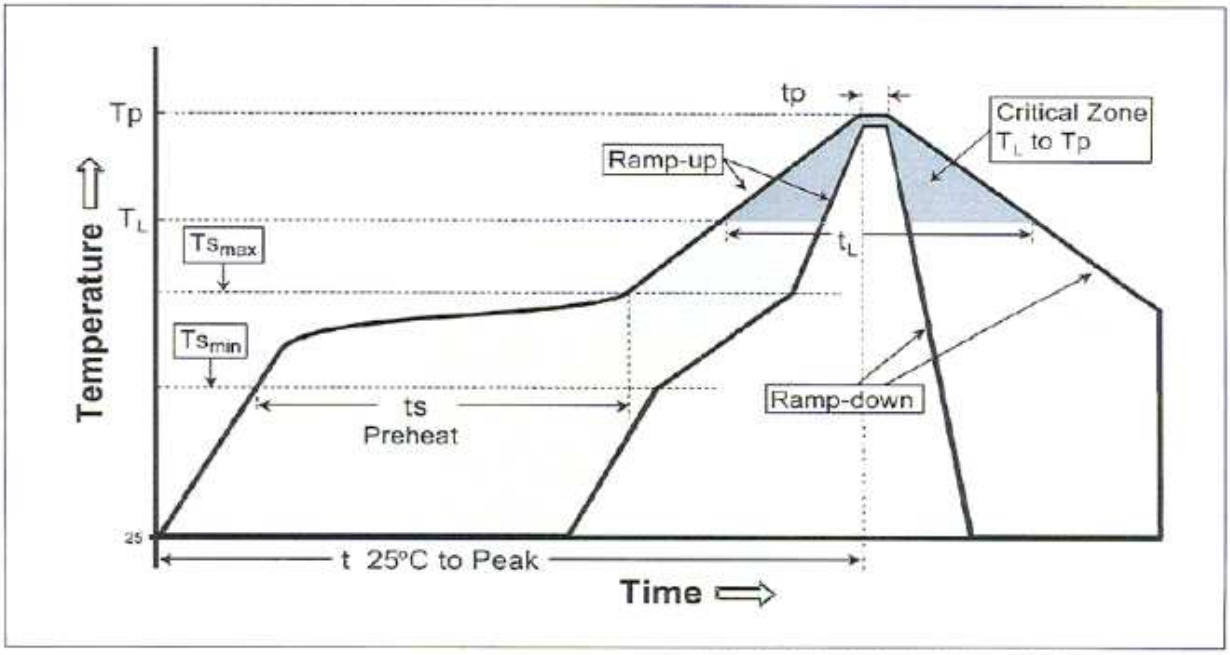
5.8. Soldering profile (RoHS process)

It must be noted that ZE51/61-2.4/SMD and XE61-2.4 modules should not be allowed to be hanging upside down during the reflow operation. This means that the module has to be assembled on the side of the printed circuit board that is soldered last.

The recommendation for lead-free solder reflow in IPC/JEDEC J-STD-020D Standard should be followed.

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-UP Rate (Ts max to Tp)	3°C/second max.	3°C/second max.
Preheat - Temperature Min (Ts min) - Temperature Max (Ts max) - Time (ts min to ts max)	 100°C 150°C 60 - 120 seconds	 150°C 200°C 60 - 120 seconds
Time maintained above: - Temperature (TL) - Time (tL)	 183°C 35 - 90 seconds	 221°C 45 - 90 seconds
Peak/Classification Temperature (Tp)	max. Peak Temp. 225°C	max. Peak Temp. 260°C
Time within 5°C of actual Peak Temperature (tp)	10 - 30 seconds	10 seconds
Ramp-Down Rate	4°C/second max.	4°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.
Minimum Solderjoint Peak-Temperature		235°C/ 10sec.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



The barcode label located on the module shield is able to withstand the reflow temperature.

It must also be noted that if the host board is submitted to a wave soldering after the reflow operation, a solder mask must be used in order to protect the tiny radio module's metal shield from being in contact with the solder wave.

6. Board Mounting recommendation

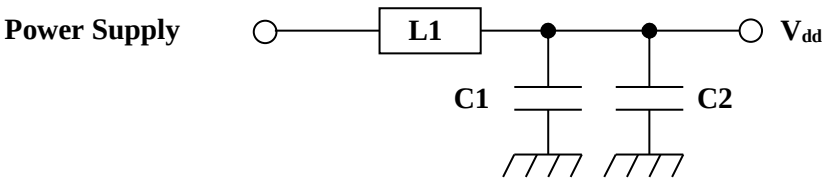
6.1. Electrical environment

The best performances of the ZE51/61-2.4 and XE61-2.4 modules are obtained in a “clean noise” environment. Some basic recommendations must be followed:

- Noisy electronic components (serial RS232, DC-DC Converter, Display, Ram, bus ,...) must be placed as far as possible from the ZE51/61-2.4 or XE61-2.4 modules.
- Switching components circuits (especially RS-232/TTL interface circuit power supply) must be decoupled with a 100 µF tantalum capacitor. And the decoupling capacitor must be as close as possible to the noisy chip.

6.2. Power supply decoupling on ZE51/61-2.4 and XE61-2.4 modules

The power supply of ZE51/61-2.4 and XE61-2.4 modules must be nearby decoupled. A LC filter must be placed as close as possible to the radio module power supply pin, VDD .

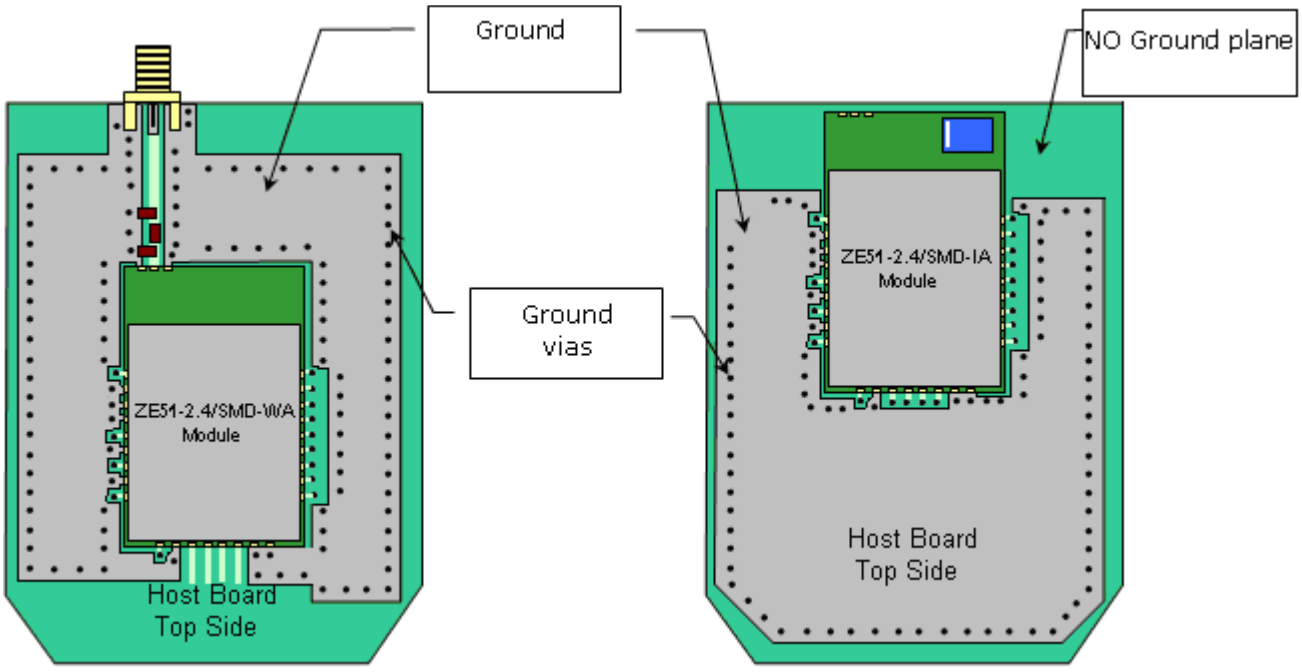


Symbols	Reference	Value	Manufacturer
L1	LQH31MN1R0K03	1µH	Murata
C1	GRM31CF51A226ZE01	22µF	Murata
C2	Ceramic SMD 25V	100nF	Multiple

6.3. RF layout considerations

Basic recommendations must be followed to achieve a good RF layout :

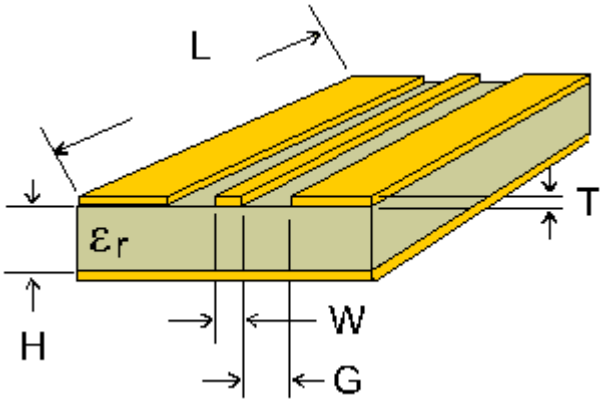
- It is recommended to fill all unused PCB area around the module with ground plane, except in case of integrated antenna (no ground plane must be placed in front of the antenna and on the bottom side).
- The radio module ground pin must be connected to solid ground plane.
- If the ground plane is on the bottom side, a via (Metal hole) must be used in front of each ground pad. Especially J28 and J30 (RF Gnd) pins should be grounded via several holes to be located right next to the pins thus minimizing inductance and preventing mismatch and losses.



Example of GND layout Top View (with and without integrated antenna)

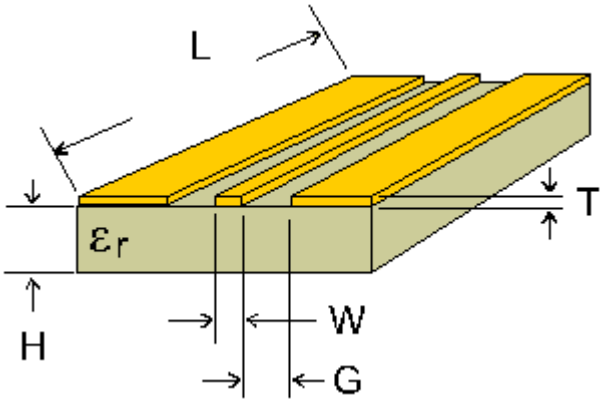
6.4. Antenna connection on Printed Circuit Boards

Special care must be taken when connecting an antenna or a connector to the module. The RF output impedance is 50 ohms, so the strip between the pad and the antenna or connector must be 50 ohms following the tables below. Ground lines should be connected to the ground plane with as many vias as possible, but not too close to the signal line.



PCB material	PCB thickness H (mm)	Coplanar line W (mm)	Coplanar line G (mm)
FR4	0.8	1	0.3
	1.6	1	0.2

Table 1: Values for double face PCB with ground plane around and under coplanar wave guide (recommended)

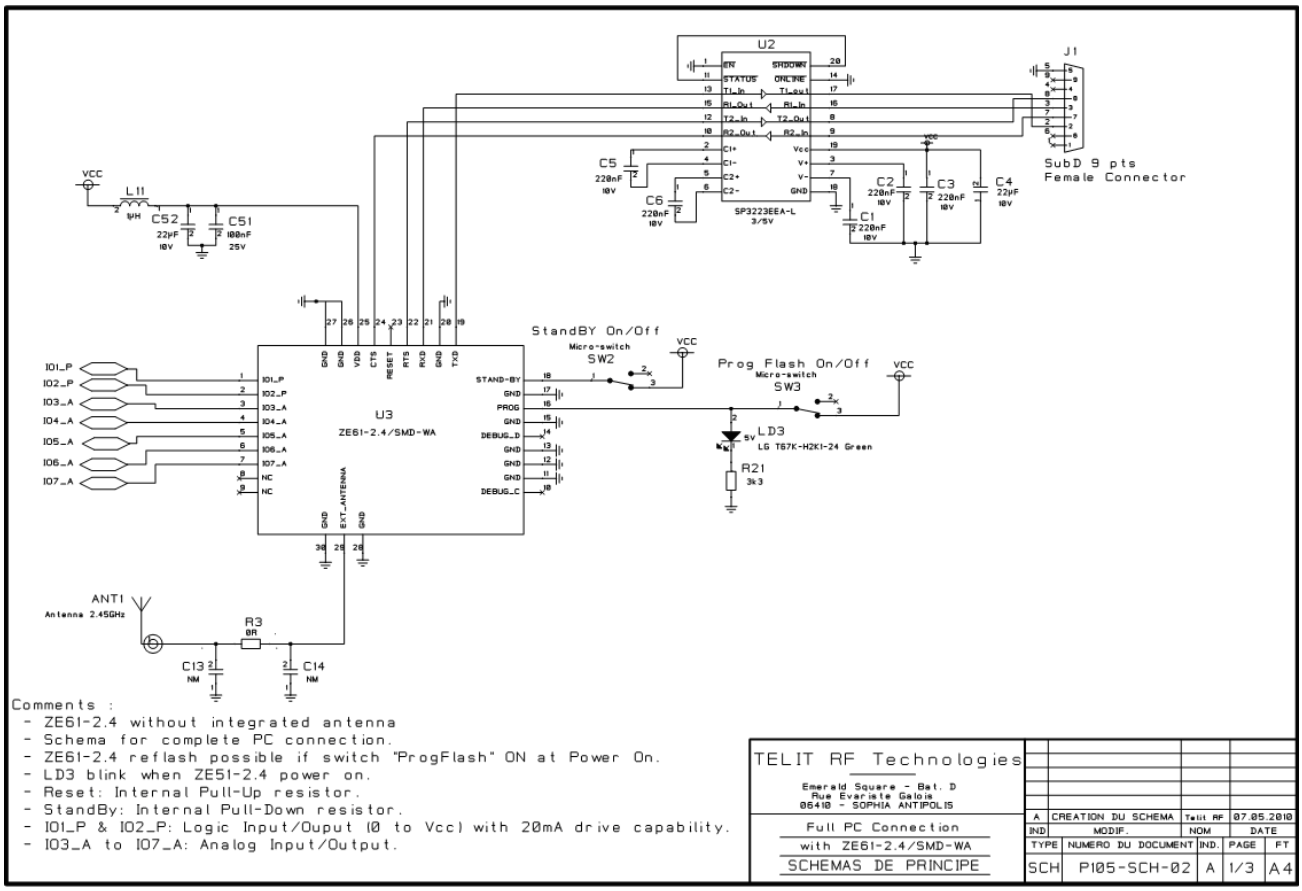


PCB material	PCB thickness H (mm)	Coplanar line W (mm)	Coplanar line G (mm)
FR4	0.8	1	0.22
	1.6	1	0.23

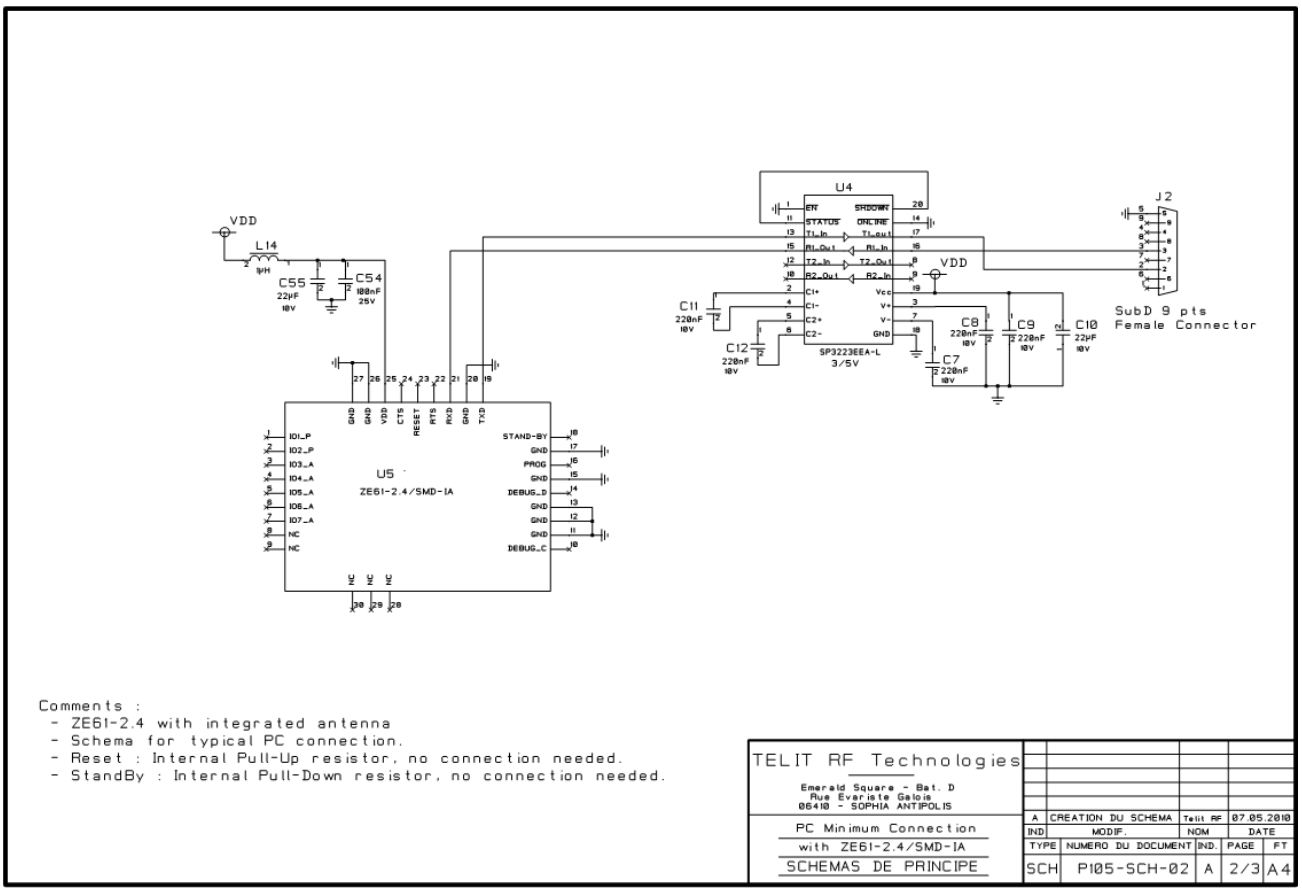
Table 2: Values for simple face PCB with ground plane around coplanar wave guide
(not recommended)

6.5. ZE51/61-2.4 and XE61-2.4 interfacing:

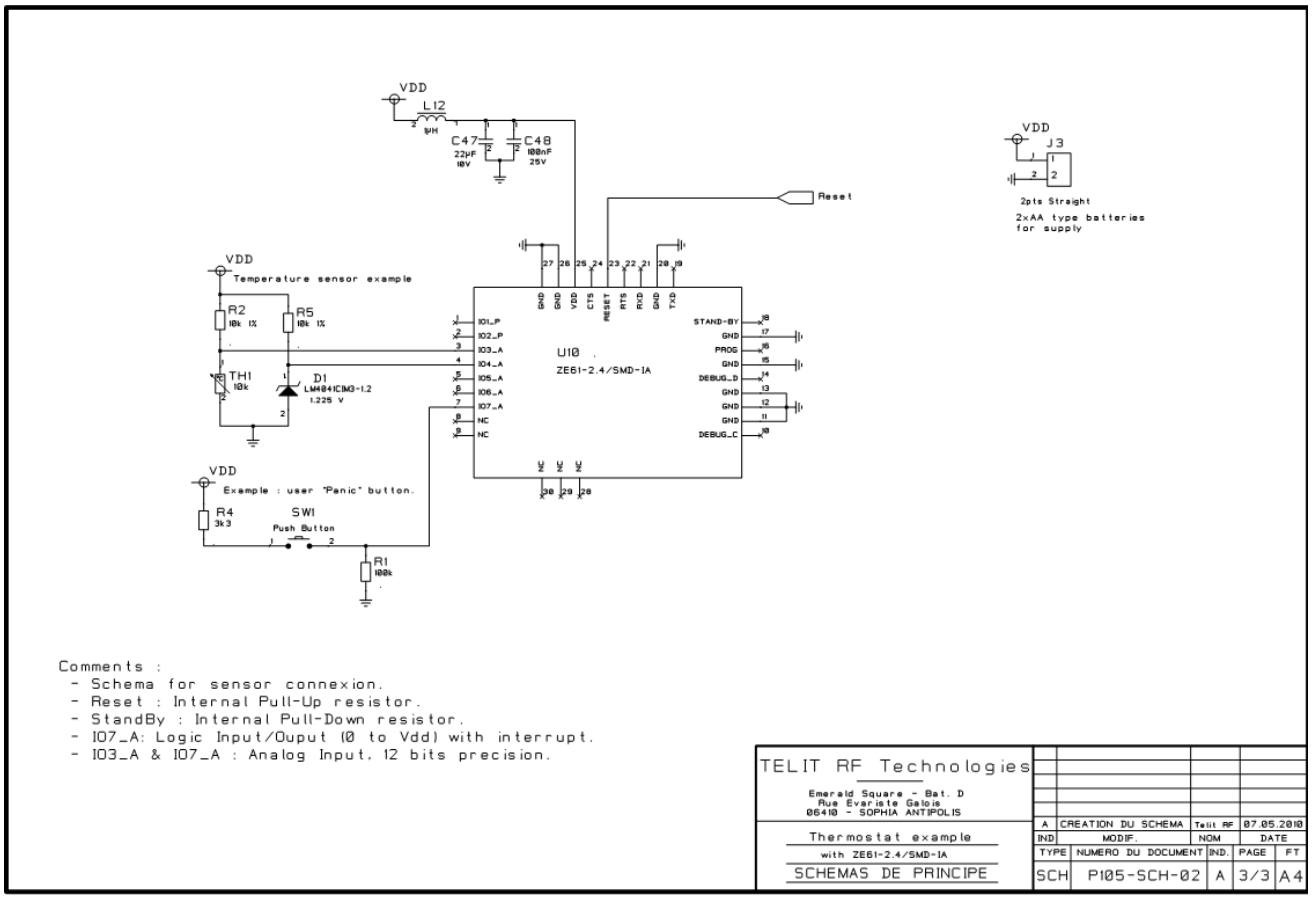
Example of a full RS-232 connection between a PC or an Automat (PLC) and ZE51/61-2.4/SMD-WA or XE61-2.4-WA



Example of a minimum PC connection with ZE51/61-2.4/SMD-IA or XE61-2.4SMD-IA.



Example for sensor connection with ZE51/61-2.4/SMD-IA or XE61-2.4/SMD-IA.



7. Antenna considerations

7.1. Antenna recommendations

ZE51/61-2.4 and XE61-2.4SMD performances when used in a product are strongly dependent on the antenna type and its location. Particular cautions are required on the following points:

- Use a good and efficient antenna designed for the 2.4 GHz band.
- Antenna must be fixed in such a location that electronic noise cannot affect the performances. (Outside location is ideal if available).
- Antenna directivity must be low (Omni directional antenna is usually the best choice).

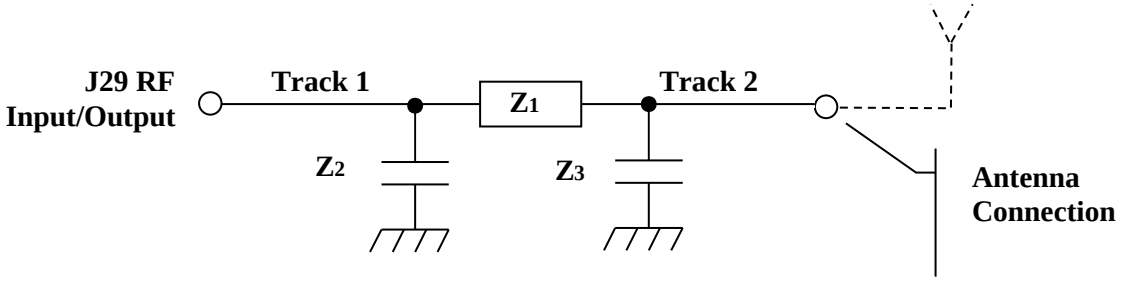
Recommended antenna specifications:

- Frequency Band : 2440MHz +/- 100MHz
- Radiation Pattern : Omni directional
- Nominal Impedance: 50 Ω
- VSWR: 1.5:1 max.
- Gain: 0dBi
- Polarization: Vertical

7.2. Antenna matching

Impedance matching can be required to deliver the maximum possible power from the module to the antenna and vice versa. This is typically accomplished by inserting a matching network into a circuit between the source and the load.

This matching network must be established as close as possible to the ZE51/61 or XE61 module.



Hereafter an example of matching network used on the DIP interface board :

Symbols	Reference	Package	Value	Comments
Z1 *	Resistor	0603	0 ohm	ZE51-2.4/DIP-WA???
	Monolithic Ceramic capacitor COG	0603	1.5 pF	ZE61-2.4/DIP-WA???
Z2, Z3 *	-	-	Not mounted	ZE51-2.4/DIP-WA???
	-	-	Not mounted	ZE61-2.4/DIP-WA???
Track 1,	Coplanar Waveguide	• Track 1 length (as short as possible) • Track 2 length (as short as possible)		
Plated holes	Ground vias : • drill of 0,35 mm • pad of 0,75 mm			

Antenna connection	Coaxial cable Pad: • Hot point: 2*2mm • Ground pad:2*4mm Or a specific SMA connector can be used.

*: These values should be measured and optimized with a Network Analyzer. If no impedance matching is necessary, replace Z1 by a 0 ohm resistor, and let Z2 and Z3 not mounted.

See the layouts §6.3 to have an idea of the antenna matching implantation.

7.3. Antenna types

The following are the antenna examples that may be suitable for ZE51/61-2.4/SMD-WA or XE61-2.4SMD-WA applications. We distinguish two types of antenna:

- External antenna (antenna is mounted outside of the device)
- Embeddable antenna (antenna is integrated inside the device)

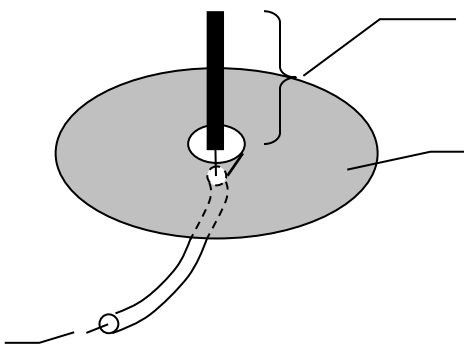
7.4. External antenna

External antenna is recommended when the range performance is primordial. For example, for base stations and access points, where a better antenna gain may be required.

7.4.1. ¼ Wave Monopole antenna:

The ¼ Wave antenna is 3 cm long @ 2.4 Ghz. Shorter compensated antennas could be used as long as they are adapted to 2.4 GHz frequency.

Best range may be achieved if the ¼ Wave antenna is placed perpendicular in the middle of a solid ground plane measuring at least 5 cm radius. In this case, the antenna should be connected to the module via some 50 ohm characteristic impedance coaxial cable.



The metallic plane must be ideally under the antenna (balanced radiation). Never short-circuit the hot and cold pins!

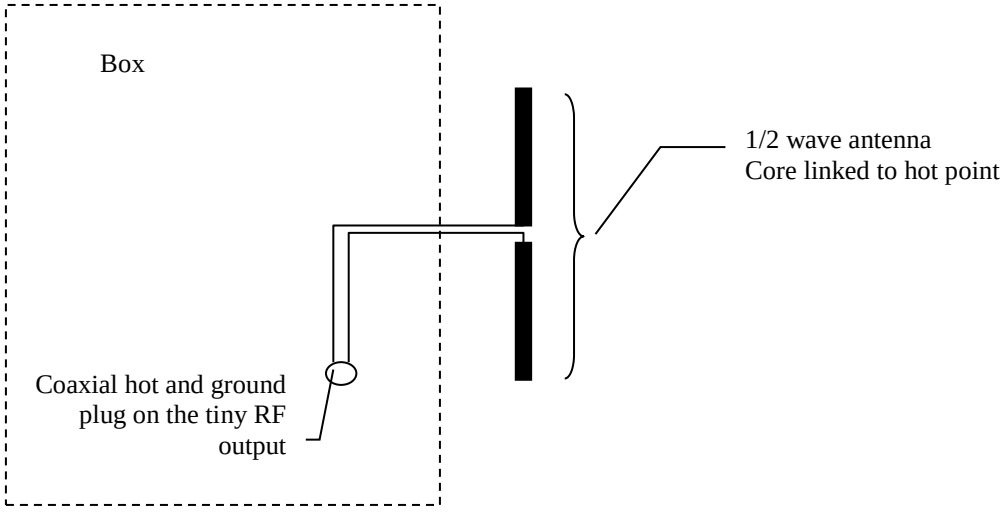
The installation directives are the following:

- Solder the coaxial cable on the hot and ground pad antenna (of the ZE51/61-2.4 or XE61-2.4 module.)
- Fix the antenna on a metallic plane or on a metallic box with the metallic screw provided with the antenna.
- If the ZE51/61-2.4 or XE61-2.4 module is integrated in a plastic box, use a metal tape (copper) glued on the plastic side under the antenna.

7.4.2. Half Wave Dipole antenna:

The ½ Wave Dipole antenna is around 6 cm long. In a ½ Wave Dipole antenna the metallic plane is replaced by a second ¼ Wave antenna balancing the radiation.

Half wave monopole antenna typically offers a ground-independent design with favorable gain, excellent radiation pattern. It has a high impedance and requires an impedance-matching circuit (See paragraph IX.3)



It is recommended to place the ½ wave dipole antenna away from all metallic object, which will detuned it.

Particularity it is not recommended to place this type of antenna directly on a metallic box, but the antenna can be deported away through a 50 ohm coaxial cable.

7.5. Embeddable antennas

In this section you will find antennas designed to be directly attached to ZE51/61-2.4/SMD-WA or XE61-2.4/SMD-WA module, inside the product casing. These antennas are only used in application where security, cosmetics, size or environmental issues make an external antenna impractical. This type of antenna is used when the integration factor becomes primordial (for mobile and handheld devices) to the range performances.

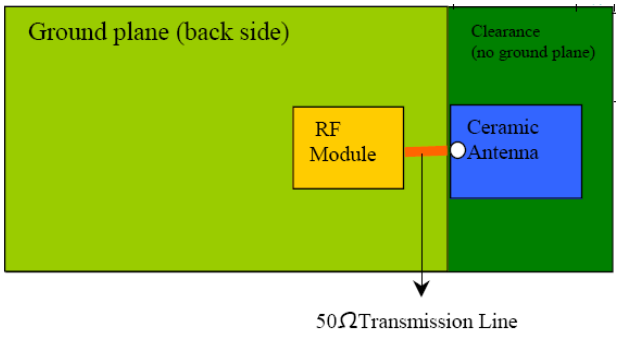
The basic recommendations are:

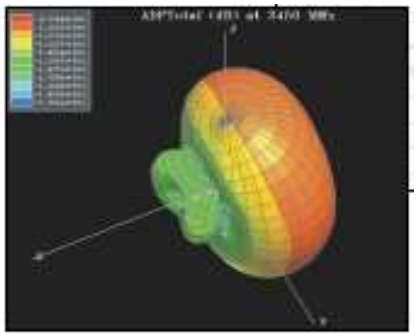
- The radio module must not be placed in a metallic casing or close to metallic devices.
- The internal antenna must be far from noisy electronic.

7.5.1. Ceramic antenna:

Ceramic antenna is a SMD component to be mounted directly on the PCB. It is designed so that it resonates and be 50 ohms at the desired frequency. But we recommended to place an impedance-matching circuit (See paragraph VII.2).

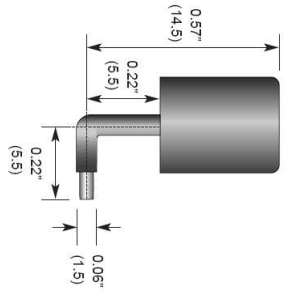
The place under and around the ceramic antenna must be free of any track or ground plane. (refer to the antenna constructor requirements). It usually has a hemispherical radiation pattern has described below.

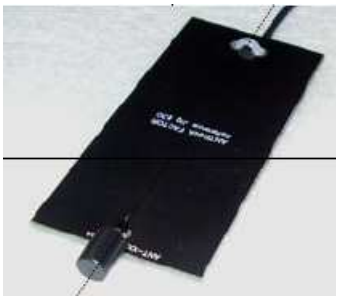


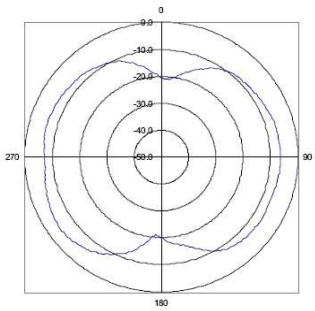


7.5.2. Miniaturized antenna:

This type of antenna features a through-hole feed line to directly attach it to the PCB. This antenna acts like a ¼ wave antenna so that a minimum ground plane is required.

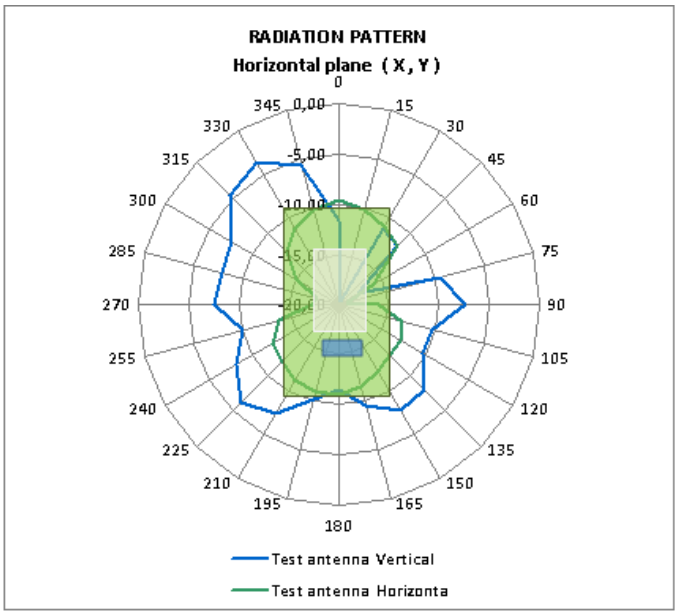


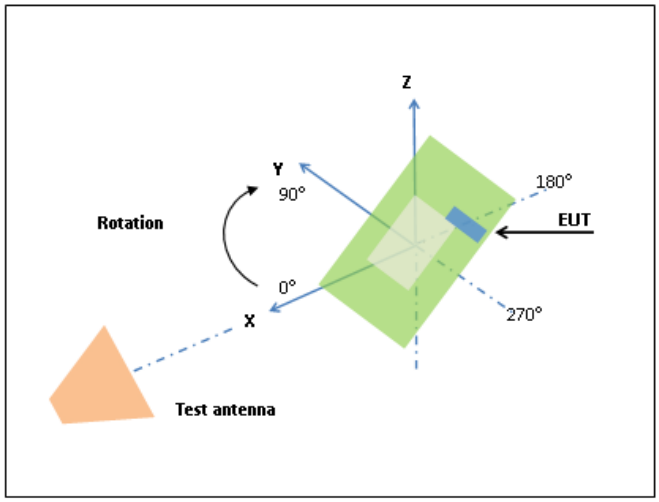


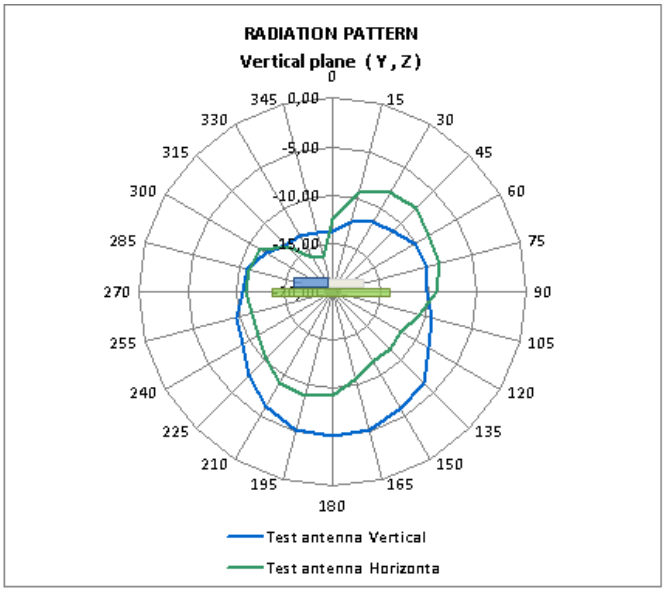


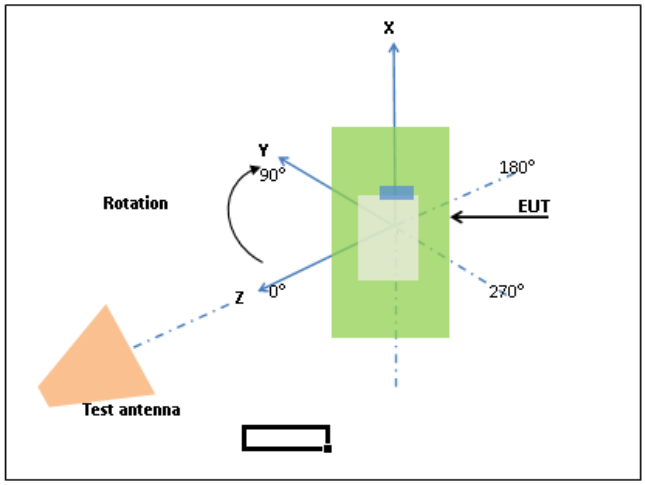
7.5.3. ZE51-2.4/SMD-IA: Integrated antenna:

ZE51-2.4 module is available with an integrated chip antenna, allowing very compact integration for small space application.







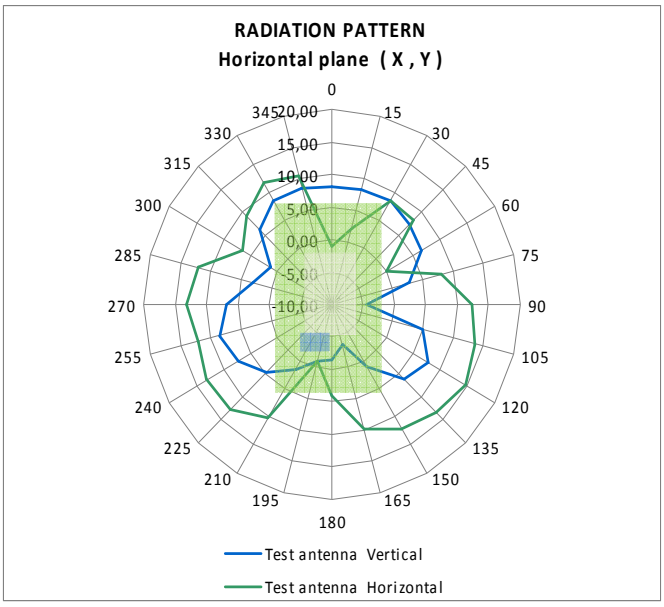


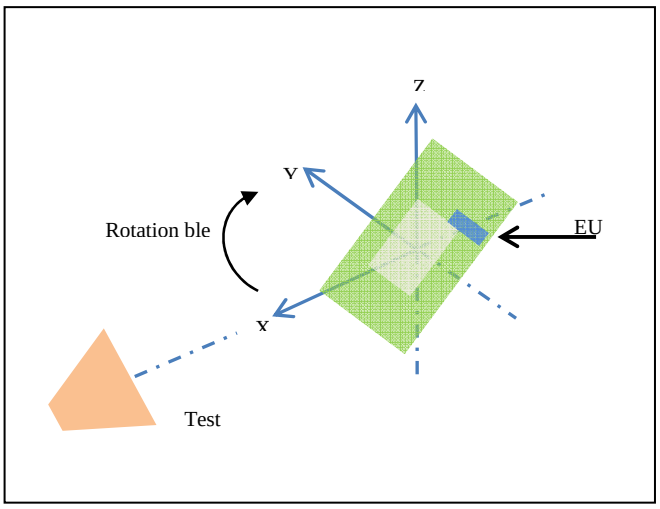
Radiation Pattern of ZE51-2.4/DIP board

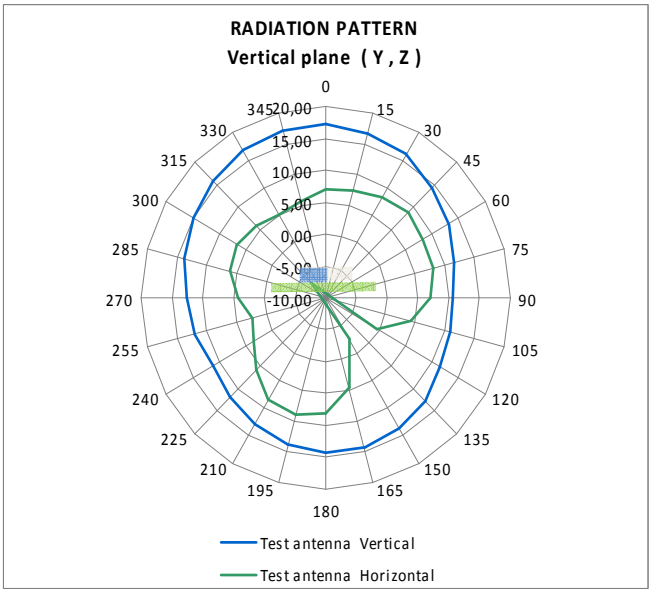
It is very important to avoid ground plane around and below the antenna, so ZE51-2.4/SMD-IA must be implemented as described in paragraph VI.3 and schematics VI.5.

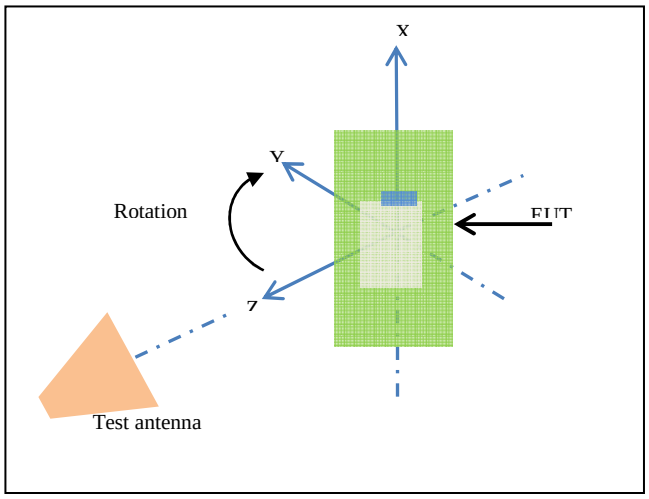
7.5.4. ZE/XE61-2.4/SMD-IA: Integrated antenna:

ZE/XE61-2.4 module is available with an integrated chip antenna, allowing very compact integration for small space application.







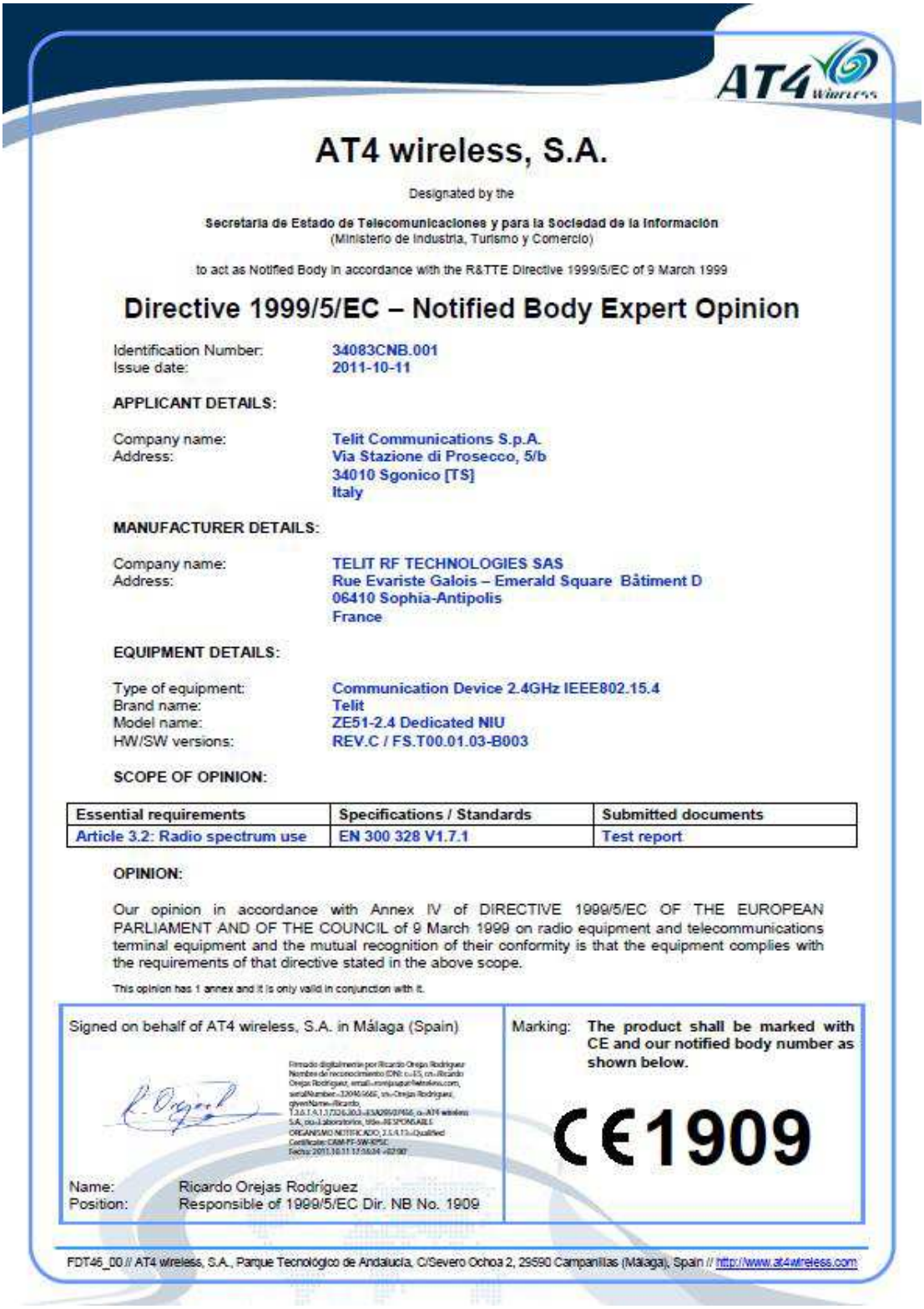


Radiation Pattern of ZE61-2.4/DIP board

It is very important to avoid ground plane around and below the antenna, so ZE/XE61-2.4/SMD-IA must be implemented as described in paragraph VI.3 and schematics VI.5.

8. ANNEXEs

8.1. Notified Body Opinion



AT4 wireless, S.A.

Designated by the

Secretaría de Estado de Telecomunicaciones y para la Sociedad de la Información
(Ministerio de Industria, Turismo y Comercio)

to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of 9 March 1999

Directive 1999/5/EC – Notified Body Expert Opinion

Identification Number: 34083CNB.001
Issue date: 2011-10-11

APPLICANT DETAILS:

Company name: Telit Communications S.p.A.
Address: Via Stazione di Prosecco, 5/b
34010 Sgonico [TS]
Italy

MANUFACTURER DETAILS:

Company name: TELIT RF TECHNOLOGIES SAS
Address: Rue Evariste Galois – Emerald Square Bâtiment D
06410 Sophia-Antipolis
France

EQUIPMENT DETAILS:

Type of equipment: Communication Device 2.4GHz IEEE802.15.4
Brand name: Telit
Model name: ZE51-2.4 Dedicated NIU
HW/SW versions: REV.C / FS.T00.01.03-B003

SCOPE OF OPINION:

Essential requirements	Specifications / Standards	Submitted documents
Article 3.2: Radio spectrum use	EN 300 328 V1.7.1	Test report

OPINION:

Our opinion in accordance with Annex IV of DIRECTIVE 1999/5/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity is that the equipment complies with the requirements of that directive stated in the above scope.

This opinion has 1 annex and it is only valid in conjunction with it.

Signed on behalf of AT4 wireless, S.A. in Málaga (Spain)

Name: Ricardo Orejas Rodríguez
Position: Responsible of 1999/5/EC Dir. NB No. 1909

Marking: The product shall be marked with CE and our notified body number as shown below.

CE 1909

FDT46_00 // AT4 wireless, S.A., Parque Tecnológico de Andalucía, C/Severo Ochoa 2, 29590 Campanillas (Málaga), Spain // http://www.at4wireless.com

Annex I to Notified Body Expert Opinion No. 32694CNB.001

TECHNICAL CONSTRUCTION FILE:

Held at:	TELIT COMMUNICATIONS S.P.A.
Address:	Via stazione di prosecco 5/B 34010 Sgonico (Trieste) Italy
Date:	2011-11-03
File number:	ZE51-2.4_ver1

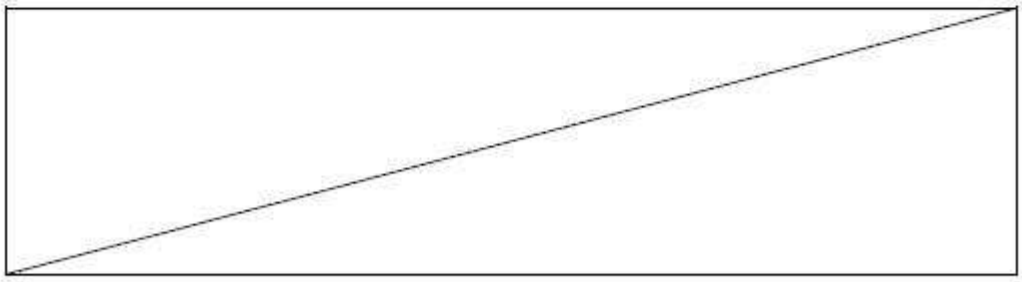
TECHNICAL FEATURES AND CHARACTERISTICS:

Operating frequency bands:	2400-2483.5 MHz
Operating frequency range:	2405-2480 MHz
Number of channels:	16
Channel spacing:	5 MHz
Operation modes:	802.15.4
Modulations:	O-QPSK with half sine pulse shaping
Data rates (maximum):	250 kbps
Chip rates (maximum):	2 Mbps
Output power (max):	3.68 dBm e.i.r.p.
Antenna:	¼ wave bended wire antenna Maximum antenna gain: 0 dBi
Intended use:	To provide M2M communication for White Goods automation through 802.15.4 short range networks

CONFORMITY DETAILS:

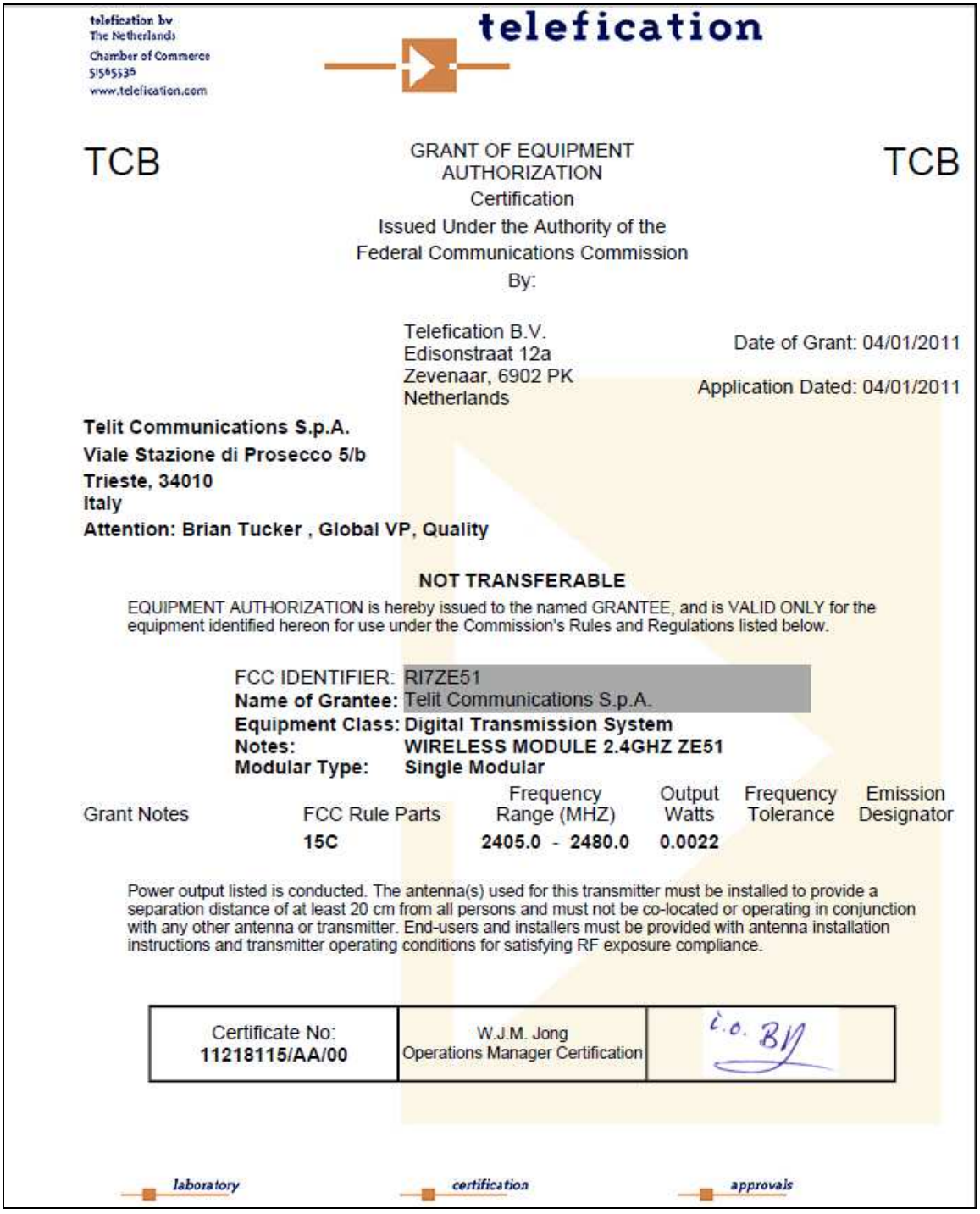
Essential requirement:	Article 3.2: Radio spectrum use
Specifications / Standards:	EN 300 328 V1.7.1
Test report No:	34083RRF.001
Issued by:	AT4 wireless, S.A.
Issue date:	2011-10-03

REMARKS AND COMMENTS:



FDT46_00 // AT4 wireless, S.A., Parque Tecnológico de Andalucía, C/Severo Ochoa 2, 29590 Campanillas (Málaga), Spain // http://www.at4wireless.com

8.2. FCC/IC Certificates



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The Netherlands
Chamber of Commerce
51565535
www.telefication.com

telefication

TCB

GRANT OF EQUIPMENT AUTHORIZATION
Certification
Issued Under the Authority of the
Federal Communications Commission
By:

TCB

Telefication B.V.
Edisonstraat 12a
Zevenaar, 6902 PK
Netherlands

Date of Grant: 04/01/2011

Application Dated: 04/01/2011

Telit Communications S.p.A.
Viale Stazione di Prosecco 5/b
Trieste, 34010
Italy
Attention: Brian Tucker , Global VP, Quality

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: RI7ZE51
Name of Grantee: Telit Communications S.p.A.
Equipment Class: Digital Transmission System
Notes: WIRELESS MODULE 2.4GHZ ZE51
Modular Type: Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15C	2405.0 - 2480.0	0.0022		

Power output listed is conducted. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Certificate No: 11218115/AA/00	W.J.M. Jong Operations Manager Certification	i.o. BV

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Chamber of Commerce
51565536
www.telefication.com

telefication

CB Industry Canada Industrie Canada

▶ Reg. No. NL0001

TECHNICAL ACCEPTANCE CERTIFICATE

CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE

CERTIFICATION No. No. DE CERTIFICATION	▶	5131A-ZE51
TELEFICATION No. No. DE TELEFICATION	▶	11217031/AA/00
TEST SITE No. No. DE LABORATOIRE	▶	4621A-1
ISSUED TO DÉLIVRÉ A	▶	TELIT COMMUNICATIONS S.P.A.
TYPE OF EQUIPMENT GENRE DE MATÉRIEL	▶	SPREAD SPECTRUM DEVICE (2400-2483.5 MHz)
TRADE NAME AND MODEL MARQUE ET MODELE	▶	TELIT ZE51-2.4
FREQUENCY RANGE BANDE DE FRÉQUENCES	▶	2405-2480 MHz
EMISSION DESIGNATION DESIGNATION D'ÉMISSION	▶	2M64G1D
R.F. POWER RATING PUISSANCE NOMINALE H.F.	▶	0.0022 W
CERTIFIED TO CERTIFIÉ SELON LE	▶	SPECIFICATION CAHIER DES CHARGES RSS-210 ISSUE EDITION 8

REMARKS/REMARQUES: Value(s) listed above respectively represent the supported transmission mode(s). Modular Approval.

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications,where applicable to use certified equipment, are acted on accordingly by the issuing office and will depend on the existing radio environment, service and location of operation.

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by the Department.

L'homologation de matériel terminal signife seulement qu'il est conforme aux exigences du cashier des charges mentionné ci-dessus. Les demandes delicence, le cas échéant en vue de l' utillisation de matériel certifié seront traitées en conséquence par le bureau chargé de délivrer lesdites licences, en tenant compte du milieu radioélectrique ambiant, du service radio existentet de l'emplacement de la station.

Le présent certificat est délivré à condition que le détenteur se conforme et continue cà se conformer aux cashiers des charges et procedures sur les norms radioélectriques publiées par le ministère.

ISSUED BY TELEFICATION BV, RECOGNIZED CERTIFICATION BODY BY INDUSTRY CANADA
DÉLIVRÉ PAR TELEFICATION BV, ORGANISME DE CERTIFICATION RECONNU PAR INDUSTRIE CANADA

DATE 18 April 2011 BY

W.J.M. Jong
Operations Manager Certification

RvA PRODUCTS RvA C 224

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Chamber of Commerce
51565536
www.telefication.com

telefication

CB Industry Canada Industrie Canada

Reg. No. NL0001

TECHNICAL ACCEPTANCE CERTIFICATE

CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE

CERTIFICATION No. / No. DE CERTIFICATION	5131A-XE61
TELEFICATION No. / No. DE TELEFICATION	11217062/AA/00
TEST SITE No. / No. DE LABORATOIRE	4621A-1
ISSUED TO / DÉLIVRÉ A	TELIT COMMUNICATIONS S.P.A.
TYPE OF EQUIPMENT / GENRE DE MATÉRIEL	SPREAD SPECTRUM DEVICE (2400-2483.5 MHz)
TRADE NAME AND MODEL / MARQUE ET MODELE	Telit ZE61-2.4, LE61-2.4
FREQUENCY RANGE / BANDE DE FRÉQUENCES	2405-2480 MHz
EMISSION DESIGNATION / DESIGNATION D'ÉMISSION	2M62G7D
R.F. POWER RATING / PUISSANCE NOMINALE H.F.	0.119 W
CERTIFIED TO / CERTIFIÉ SELON LE	SPECIFICATION / CAHIER DES CHARGES RSS-210 ISSUE / EDITION 8

REMARKS/REMARQUES: Value(s) listed above respectively represent the supported transmission mode(s).

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications,where applicable to use certified equipment, are acted on accordingly by the issuing office and will depend on the existing radio environment, service and location of operation.

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by the Department.

L'homologation de materiel terminal signifie seulement qu'il est conforme aux exigences du cashier des charges mentionne ci-dessus. Les demandes delicence, le cas échéant en vue de l' utillisation de materiel certifié seront traitees en consequence par le bureau chargé de delivrer lesdites licences, en tenant compte du milieu radioelectrique ambiant, du service radio existentet de l'emplacement de la station.

Le présent certificat est delivré a condition que le détenteur se conforme et continue ca se conformer aux cashiers des charges et procedures sur les normes radioelectriques publiées par le ministère.

ISSUED BY TELEFICATION BV, RECOGNIZED CERTIFICATION BODY BY INDUSTRY CANADA
DÉLIVRÉ PAR TELEFICATION BV, ORGANISME DE CERTIFICATION RECONNU PAR INDUSTRIE CANADA

DATE 27 June 2011 BY

W.J.M. Jong
Operations Manager Certification

i.o. BV

RvA PRODUCTS RvA C 224

laboratory certification approvals

8.3. Conformity Assessment Issues

8.3.1. FCC Notice

Modules ZE51/61 and XE61 are FCC/IC approved as modules to be installed in other devices. If the final product after integration is intended for portable use, a new application and FCC/IC is required.

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.

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Telit Communications S.P.A. may void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Wireless notice:

This product emits radio frequency energy, but the radiated output power of this device is far below the FCC radio frequency exposure limits. This equipment complies with FCC RF radiation exposure limits forth for an uncontrolled environment. Nevertheless, the device should be used in such a manner that the potential for human contact with the antenna during normal operation is minimized.

8.3.2. IC Notice

This Class B digital apparatus complies with Canadian ICES-003, RSS-Gen and RSS-210.

Cet appareil numérique de la classe B est conforme à la norme NMB-003, CNR-Gen et CNR-210 du Canada

These radio transmitters ID: 5131A-ZE51 and 5131A-xE61 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Les présent émetteures radio ID: 5131A-ZE51 e 5131A-xE61 a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

	Fractus Micro Reach Xtend™ Chip antenna	**Taoglas Dipole Stub**
Antenna gain	2 dBi	5 dBi
Antenna impedance	50 Ω	50 Ω

Wireless notice

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

8.3.3. Label recommendations

If neither FCC ID nor IC ID is visible when the module is installed inside another device, then the outside of the device into which the module is installed will display a label referring to the enclosed module by labelling the host device in this manner: "Contains FCC ID: RI7ZE51 and IC ID: 5131A - ZE51" or "Contains FCC ID: RI7xE61 and IC ID: 5131A –xE61"

8.3.4. 1999/5/EC Directive

The ZE61-2.4 WA or XE61-2.4 WA module has been evaluated against the essential requirements of the 1999/5/EC Directive.

In order to satisfy the essential requirements of 1999/5/EC Directive, ZE/XE61-2.4 module is compliant with the following standards:

RF spectrum use (R&TTE art. 3.2)	**EN 300 328-2 V1.7.1**
EMC (R&TTE art. 3.1b)	**EN 301 489-1 V1.8.1** **EN 301 489-17 V2.1.1**
Health & Safety (R&TTE art. 3.1a)	**EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011**

The conformity assessment procedure referred to in Article 10 and detailed in Annex IV of Directive 1999/5/EC has been followed with the involvement of the following Notified Body Notified Body:

AT4 wireless, S.A.

Parque Tecnologico de Andalucía

C/ Severo Ochoa 2

29590 Campanillas – Málaga

SPAIN

Notified Body No: 1909

The Technical Construction File (TCF) relevant to the product described above is held at:

Telit Communications S.p.A

Via Stazione di Prosecco, 5/b

34010 Sgonico (TRIESTE)

Italy

This equipment can be operated in the EU without restrictions indoor, but cannot be operated outdoors in France until further notice.

Thus, the following marking is included in the product:

CE 1909 !

Final product integrating this module must be assessed against essential requirements of the 1999/5/EC (R&TTE) Directive. It should be noted that assessment does not necessarily lead to testing. TELIT RF TECHNOLOGIES SAS recommends carrying out the following assessments:

RF spectrum use (R&TTE art. 3.2)	**It will depend on the antenna used on the final product.**
EMC (R&TTE art. 3.1b)	**Testing**
Health & Safety (R&TTE art. 3.1a)	**Testing**

Alternately, assessment of the final product against EMC (Art. 3.1b) and Electrical safety (Art. 3.1a) essential requirements can be done against the essential requirements of the EMC and the LVD Directives:

Low Voltage Directive 2006/95/EC and product safety

Directive EMC 2004/108/EC for conformity for EMC

8.3.5. ANATEL Notice

This equipment operates as secondary functionality that is not entitled to protection from harmful interference, even for stations of the same type, and cannot cause interference to systems operating as primary functionality.

8.3.6. NCC Warning Statement

NCC 警語低功率電波輻射性電機管理辦法第十二條經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。第十四條低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾

8.4. Output power programming

The results are measured on the ZE/XE61-2.4/DIP interface with T = 25°C, Vdd = 3 V, 2440 Mhz, 50 ohm impedance if nothing else noted.

TxPower register ATS202	Power (dBm)	Current (dBm)	Comments
0	20	175	Not recommended
1	19.5	160	Default value
2	19	145	
3	18.5	135	
4	17.5	124	
5	16.5	113	
6	15	102	
7	14	96	
8	12.5	89	
9	11	84	
10	9	80	

9. Glossary

ARIB	Association of Radio Industries and Businesses
BER	Bit Error Rate
Bits/s	Bits per second (1000 bits/s = 1Kbps = 1Kbaud)
CEPT	European Conference of Postal and Telecommunications Administrations
CFR	Code of Federal Regulations
Chips	Chip or chip sequence refers to a spreading-code used to transform the original data to DSSS
CW	Continuous Wave
dBm	Power level in decibel milliwatt (10 log (P/1mW))
DSSS	Direct Sequence Spread Spectrum
EIRP	Effective Isotropic Radiated Power
EMC	Electro Magnetic Compatibility
EPROM	Electrical Programmable Read Only Memory
ERC	European Radiocommunications Committee
ETR	ETSI Technical Report
ETSI	European Telecommunication Standard Institute
FCC	Federal Communications Commission
IEEE	Institute of Electrical and Electronics Engineers
ISM	Industrial, Scientific and Medical
KB	1024 bytes (1 byte = 8 bits)
Kbps	kilobits/s
LBT	Listen Before Talk
LNA	Low Noise Amplifier
MAC	Medium Access Control
MHz	Mega Hertz (1 MHz = 1000 kHz)
Mchip/s	Mega chips per second (A measure of the speed with which chips are generated in DSSS)
PCB	Printed Circuit Board
PROM	Programmable Read Only Memory
PER	Packet Error Rate
PHY	Physical Layer
NRZ	Non return to Zero
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Receive Strength Signal Indicator
Rx	Reception
SRAM	Static Random Access Memory
SRD	Short Range Device
SMD	Surface Mounted Device
Tx	Transmission
Via	Metal Hole on a printed circuit board
WPANs	Wireless Personal Area Networks

10. Document History

Revision	Date	Changes
0	2010-05-10	First Release
1	2010-07-28	Added ZE61-2.4
2	2011-02-04	Updated regulation requirements and schematics in VI.5
3	2011-03-14	• Added link for ZE51 USB dongle drivers, info regarding CC debugger. • Added in Annex paragraph regarding Conformity Assessment Issues FCC/IC and Declaration of conformity
4	2011-09-22	• Added FCC/IC Certificates • Added text regarding Conformity Assessment Issues FCC/IC and FCC/IC Certification • Update of Reference documents • Update DC characteristics • Update Functional characteristics • Update Absolute maximum ratings • Update DIP module mechanical dimensions and pin-out labels • Updated Correspondence table and Antenna matching • Added ZE61-2.4/DIP board radiation pattern
5	2011-12-20	• Pin-out correspondence table for ZE51 and for ZE61 are indicated separately • Added NBO
6	2012-01-10	• Pin-out correspondence table updated
7	2012-04-03	• Changed 8.4, adding Anatel Notice
8	2012-05-16	• Added XE61-2.4 in the document name an as reference product in all document • Added 8.3.4 - 1999/5/EC Directive
9	2014-10-07	• Added NCC Warning Statement and updated 5.2 and 3.7
10	2015-03-19	• Updated ch.5 Process information and Democase contents