WE310F5-I/P Module

Hardware User Guide

1VV0301662 Rev. 14 – 2021-07-07

Telit Technical Documentation

APPLICABILITY TABLE

PART NUMBER
WE310F5-I
WE310F5-P

Contents

1. INTRODUCTION

1.1. Scope

This document describes electrical specifications, mechanical information, interfaces application, and manufacturing information about the Telit WE310F5-I/P Wi-Fi/BLE module. With the help of this document and other application notes or user guides, users can understand the Telit WE310F5-I/P Wi-Fi/BLE module well and develop various products quickly.

1.2. Audience

This document is intended for Telit customers, especially system integrators, about to implement their applications using the Telit module.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
- *TS-SRD@telit.com*

Alternatively, use: *http://www.telit.com/support*

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit *http://www.telit.com*

We aim 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. Symbol Convention

Table 1: Symbol Convention

	**Danger:** This information MUST be followed, or catastrophic equipment failure or personal injury may occur.
	**Warning:** Alerts the user on important steps about the module integration.

Note/Tip: Provides advice and suggestions that may be useful when integrating the module.

Electrostatic Discharge: Notifies the user to take proper grounding precautions before handling the product.

All dates are in ISO 8601 format, that is. YYYY-MM-DD.

1.5. Related Documents

Table 2: Related documents

Module Name	Description
80664ST11034A	WE310F5-I/P AT Command Reference Guide Rev 9.0
1VV0301663	WE310F5-I/P EVB Hardware User Guide Rev 4.0

2. GENERAL PRODUCT DESCRIPTION

2.1. Overview

The WE310F5-I/P is a module with a single-band Wi-Fi/BLE (5.0) 2.4GHz combo module that provides an easy and cost-effective way for users to add wireless connectivity to their products. This module is available in two different factors the antenna version named WE310F5-I with 15mmx18mm dimensions and an on-board multilayer antenna and the WE310F5-P with 13.1mmX14.3mm with antenna PAD. The two versions share the same Pinout and are P2P compatible.

2.2. Product Variants and Frequency Bands

The Telit WE310F5 module is available in two variants. For details on the differences between the two variants.

- WE310F5-I
- WE310F5-P

WE310F5-I	WE310F5-P

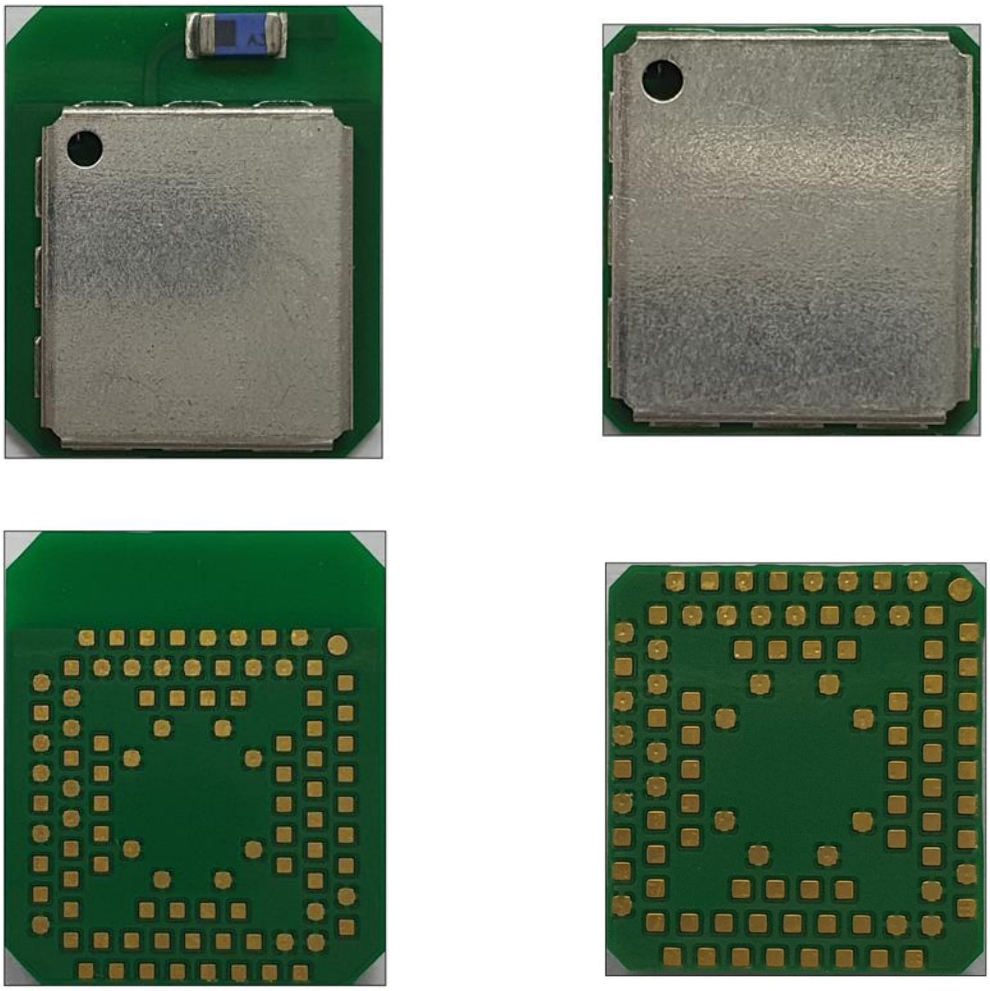

Figure 1: Product Variants and Frequency Band

Note/Tip:

(EN) The integration of the WE310F5-I/P module within the user application shall be done according to the design rules described in this manual.

(IT) L'integrazione del modulo cellulare WE310F5-I/P all'interno dell'applicazione dell'utente dovrà rispettare le indicazioni progettuali descritte in questo manuale.

(DE) Die Integration des WE310F5-I/P Mobilfunk-Moduls in ein Gerät muß gemäß der in diesem Dokument beschriebenen Kunstruktionsregeln erfolgen.

(SL) Integracija WE310F5-I/P modula v uporabniški aplikaciji bo morala upoštevati projektna navodila, opisana v tem priročniku.

(SP) La utilización del modulo WE310F5-I/P debe ser conforme a los usos para los cuales ha sido deseñado descritos en este manual del usuario.

(FR) L'intégration du module cellulaire WE310F5-I/P dans l'application de l'utilisateur sera faite selon les règles de conception décrites dans ce manuel.

[HE] האינטגרטור מתבקש ליישם את ההנחיות המפורטות במסמך זה בתהליך האינטגרציה של המודם הסלולרי WE310F5-I/P עם המוצר.

2.3. Block Diagram

The following figure shows a high-level block diagram of the WE310F5-I/P module and its major functional blocks.

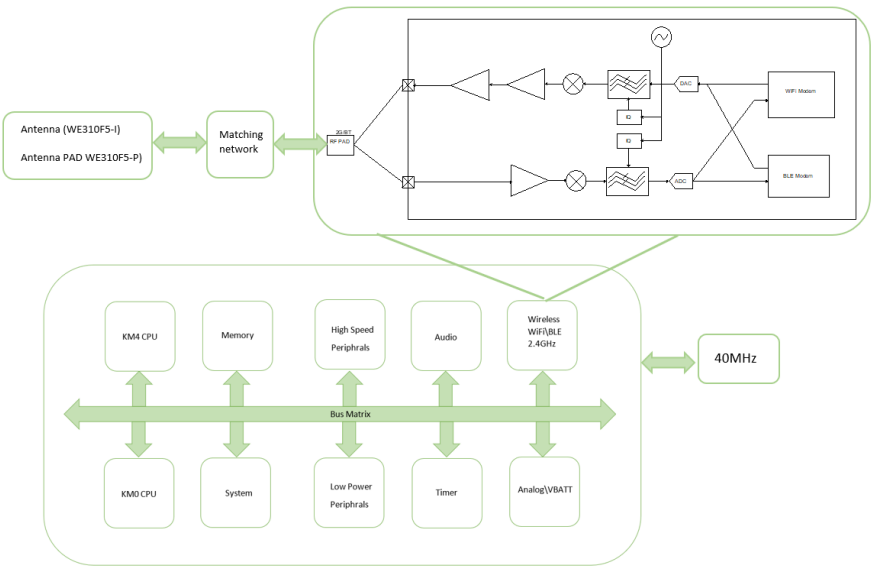

Figure 2:Telit WE310F5-I/P module block diagram

3. FEATURES

3.1. Main Features

1. Highly integrated single chip with low power single-band (2.4GHz) Wireless LAN (WLAN) and Bluetooth Low Energy (BLE5.0) communication controller.
2. Dedicated ArmV8-M Cortex-M33 (KM4) processor + low power Armv8-M Cortex-M23 (KM0) WLAN (802.11 b/g/n) MAC, a 1T1R capable WLAN, and Bluetooth.
3. FLASH Memory 4Mbytes(32Mbits)
4. 456Kb RAM
5. Retention SRAM 156Kb

Table 3: Main Features

Item	Description
Wi-Fi	802.11 b/g/n 1X1 2.4GHz 20MHz/40MHz Channel width Data rates up to MCS7 Low power architecture Low Power Tx/Rx for short-range application Low Power beacon listen mode Low power Rx mode Very low power suspend mode (DLPS) Built-in PA Internal PTA interface for arbitrating data transmission between Wi-Fi and Internal Bluetooth or external 2.4G devices
BT BLE	BLE 5.0 Both central and peripheral modes High power mode (8dBm, shares the same PA with Wi-Fi) Internal Co-existence mechanism between Wi-Fi and BT to share the same antenna
Temperature Range	Operating: -40°C ~ 85°C Junction: -40°C ~ 105°C Storage: -55°C ~ 125°C

The WE310F5-I/P module supports the following peripherals Interfaces.

Table 4: Supported Peripherals

Item	Peripherals	Comment
UART	UART0	Low Power Mode Wakeup
	AUX_UART	LOG UART/Low power mode wakeup (no Flow control))
SPI	SPI0	Master/Slave Clock up to 50 MHz
I2C	HS_I2C	Standard/fast/high speed mode (up to 3.33Mbps)

SDIO	1-Bit SDIO mode	Maximum Clock 50 MHz
PWM	HS_PWM8/ LP_PWM2	
DVI	I2S	Sampling rates: 8kHz ~ 176.4kHz Mono, stereo, and 5.1 channel. The sample size for Mono: 16-bit, 32-bit The sample size for Stereo & 5.1 channel: 16-bit, 24-bit 32 bit. PCM not supported
WAKEUP		Wake up from deep sleep
USB		USB 2.0 device
ADC	12-bit SAR ADC	Single ended input Range: 0~3.3V
RTC		12- or 24-hour format (seconds, minutes, hours, days) Daylight saving compensation Register write protection

3.2. Bootloader

The bootloader sits in internal NOR flash. The firmware can be flashed only through AUX_UART. To program the firmware to the module, TX_AUX (pin Y10) must be LOW before power on or reset.

3.3. ESD Characteristics

The ESD characteristics of the WE310F5-I/P modules are shown in the following table.

Table 5: ESD Characteristics of WE310F5-I/P modules

ESD	V
Human Body Model (HBM)	±2000
Charge Device Model	± 500

3.4. SAR ADC Characteristics

Table 6: SAR ADC Characteristic

Parameter	Condition	Minimum	Typical	Maximum	Unit
Temperature		-40	25	125	C°
Resolution	Bypass mode		12		Bits
	Resistor driver mode		12		Bits
Clock Source	From digital			1000	kHz
DC Offset Error	Cover VBAT=1.62~3.63V		2		LSB

4. PIN ALLOCATION

4.1. PIN-Out

All IO's are in LVTTL 3.3V logic.

Table 7: SAR ADC Characteristic

Pin	Signal	I/O	Function	Comment	Pull-down Restriction
Primary serial port (HW Flow Control)					
Y16	RXD0	I	Serial data Input (RXD)		>1K
AA15	TXD0	O	Serial data Output (TXD)		>1K
Y18	CTS0	I	Input for Clear to send signal (CTS)		>1K
AA17	RTS0	O	Output for Request to send signal (RTS)		>1K
USB					
U19	USB_D+	I/O	USB differential Data (+)		>1K
V18	USB_D-	I/O	USB differential Data (-)		>1K
Auxiliary Serial Port					
Y10	TX_AUX	O	Auxiliary (DEBUG) UART output		>1K
AA9	RX_AUX	I	Auxiliary (DEBUG) UART input		>1K
DIGITAL IO					
V11	IO1/I2C_SCL	I/O	Configurable GPIO_01		
V13	IO2/I2C_SDA	I/O	Configurable GPIO_02		
D7	IO3/SD_D0	I/O	Configurable GPIO_03		
D9	IO4	I/O	Configurable GPIO_04	I2S_MCLK	
D11	IO5	I/O	Configurable GPIO_05		
D13	IO6	I/O	Configurable GPIO_06		
SPI					
AA5	SPI_MOSI	I/O	MOSI		
Y6	SPI_CS	I/O	Chip Select		>1K
AA7	SPI_CLK	I/O	Clock		>1K
Y8	SPI_MISO	I/O	MISO		>1K
ADC and DAC					
B18	ADC	I	Analog to Digital Converter Input	0V ~ 3.3V	>1K
R16	DAC	O	PWM output		

RF					
A5	WIFI/BT ANTENNA	I/O	RF pad (50 ohm) on P variant		

Miscellaneous					
N16	ON*	I	RESET pin	Active low	
L16	WAKEUP	I	WAKEUP Module from sleep		>1K

Audio					
C1	DVI_WA0	O	I2S Frame Sync		
D2	DVI_RX	O	I2S RX		
E1	DVI_TX	I	I2S TX		
F2	DVI_CLK	I	I2S CLK		

Power Supply					
W1	VBATT_3V3	-	Main power supply 3.3V	Power	
AA3	VBATT_3V3	-	Main power supply 3.3V	Power	
A3	GND	-	RF Ground	Power	
A7	GND	-	RF Ground	Power	
A9	GND	-	RF Ground	Power	
A13	GND	-	RF Ground	Power	
A17	GND	-	RF Ground	Power	
B4	GND	-	RF Ground	Power	
B6	GND	-	RF Ground	Power	
B10	GND	-	RF Ground	Power	
B12	GND	-	RF Ground	Power	
B14	GND	-	RF Ground	Power	
B16	GND	-	RF Ground	Power	
C19	GND	-	RF Ground	Power	
D18	GND	-	RF Ground	Power	
F8	GND	-	Thermal Ground	Power	
F12	GND	-	Thermal Ground	Power	
F18	GND	-	Thermal Ground	Power	
G19	GND	-	Thermal Ground	Power	
H6	GND	-	Thermal Ground	Power	
H14	GND	-	Thermal Ground	Power	
J19	GND	-	Thermal Ground	Power	
K18	GND	-	Thermal Ground	Power	
M18	GND	-	Thermal Ground	Power	
N19	GND	-	Thermal Ground	Power	
P6	GND	-	Thermal Ground	Power	
P14	GND	-	Thermal Ground	Power	
T8	GND	-	Thermal Ground	Power	

T12	GND	-	Thermal Ground	Power	
U1	GND	-	Power Ground	Power	
V2	GND	-	Power Ground	Power	
W19	GND	-	Power Ground	Power	
Y2	GND	-	Power Ground	Power	
Y4	GND	-	Power Ground	Power	

Debug Port (SWD)				
J4	SWD_CLK	SWD_CLK		
L4	SWD_DATA	SWD_DATA	Bootstrap pin. LOW for SWD	

RESERVED					
A1	RESERVED	-	RESERVED		
A11	RESERVED	-	RESERVED		
A15	RESERVED	-	RESERVED		
B2	RESERVED	-	RESERVED		
B8	RESERVED	-	RESERVED		
E19	RESERVED	-	RESERVED		
G1	RESERVED	-	RESERVED		
G4	RESERVED	-	RESERVED		
G16	RESERVED	-	RESERVED		
H2	RESERVED	-	RESERVED		
H18	RESERVED	-	RESERVED		
J1	RESERVED	-	RESERVED		
J16	RESERVED	-	RESERVED		
K2	RESERVED	-	RESERVED		
L1	RESERVED	-	RESERVED		
L19	RESERVED	-	RESERVED		
M2	RESERVED	-	RESERVED		
N1	RESERVED	-	RESERVED		
N4	RESERVED	-	RESERVED		
P2	RESERVED	-	RESERVED		
P18	RESERVED	-	RESERVED		
R1	RESERVED	-	RESERVED		
R4	RESERVED	-	RESERVED		
R19	RESERVED	-	RESERVED		
T2	RESERVED	-	RESERVED		
T18	RESERVED	-	RESERVED		
V7	RESERVED	-	RESERVED		
V9	RESERVED	-	RESERVED		
Y12	RESERVED	-	RESERVED		
Y14	RESERVED	-	RESERVED		

AA11	RESERVED	-	RESERVED		
AA13	RESERVED	-	RESERVED		

Note/Tip: Reserved Pins must not be connected.

5. POWER SUPPLY

5.1. Power Supply Requirements

The WE310F5-I/P can be directly supplied by a 3.3V power supply source capable of at least 500mA or higher.
The voltage supply to all the required parts of the chipset is provided by an embedded switching regulator.

Table 8: Power Supply Requirements

Power Supply	Minimum	Typical	Maximum
Main Power ratings	3.0 V	3.3V	3.6 V

5.2. Logic Levels

Table 9: Logic Levels

Levels with VIO = 3.3V	Min
V_{IH} Input high level	2.0V
V_{IL} Input low level	-
V_{OH} Output high level	2.4V
V_{OL} Output low level	-
I_{T+} Schmitt-trigger High Level	1.78V
I_{T-} Schmitt-trigger Low Level	1.36V
I_{LL} input-Leakage Current	-10 A
Levels with VIO = 3.3V	Min
V_{IH} Input high level	2.0V
V_{IL} Input low level	-
V_{OH} Output high level	2.4V

5.3. Power Up and Shutdown Sequences

Module power up and shutdown sequences are shown below:

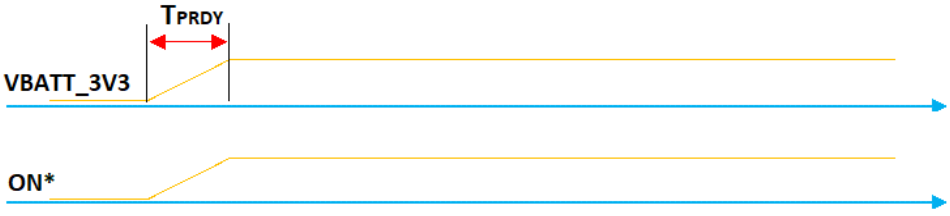

Figure 3: Power UP Sequence

Figure 4: Shutdown Sequence

Table 10: Timing Specification of -Power up/shutdown sequence

Symbol	Parameter	Minimum	Typical	Maximum	Unit
TPRDY	VDD_IO ready time	0.6	0.6	1	ms
VRST	Shutdown occurs after ON* lower than this voltage	0	0	0.5*VBATT_3V3	V
TRST	The required time when ON* lower than VRST	10	10	-	s

6. RF SPECIFICATIONS

6.1. Wi-Fi Tx Power

The Wi-Fi Transmit power at RF pad at 25 °C @3.3V.

Table 11: Wi-Fi Tx Power

Wi-Fi CH 6 WE310F5-I/P*	Modulation	Data Rates	RF Output (dBm)
b	BPSK	1 Mbps	18.0
	QPSK	2 Mbps	18.0
	CCK	5.5 Mbps	18.0
	CCK	11 Mbps	18.0
g	BPSK	6 Mbps	18.0
	BPSK	9 Mbps	17.0
	QPSK	12 Mbps	17.0
	QPSK	18 Mbps	16.5
	16 QAM	24 Mbps	16.5
	16 QAM	36 Mbps	16.0
	64 QAM	48 Mbps	16.0
	64 QAM	54 Mbps	16.0
n	BPSK	MCS0_20	17.0
	QPSK	MCS1_20	16.0
	QPSK	MCS2_20	16.0
	16 QAM	MCS3_20	15.5
	16 QAM	MCS4_20	15.5
	64 QAM	MCS5_20	15.0
	64 QAM	MCS6_20	15.0
	64 QAM	MCS7_20	15.0
	BPSK	MCS0_40	16.0
n	QPSK	MCS1_40	15.0
	QPSK	MCS2_40	15.0
	16 QAM	MCS3_40	14.5
	16 QAM	MCS4_40	14.5
	64 QAM	MCS5_40	14.0
	64 QAM	MCS6_40	14.0
	64 QAM	MCS7_40	14.0

** For the P version remove the antenna and apply a pigtail to the hot pad.*

6.2. BLE Tx Power

BLE transmit power with at RF Pad at 25 °C.

Table 12: BLE Tx Power

Packet Type	Output Power (dBm)
LE 1M	5
LE 2M	5

** For the P version remove the antenna and apply a pigtail to the hot pad.*

6.3. Wi-Fi Rx Sensitivity

Wi-Fi Rx sensitivity at RF pad @ 25 °C.

Table 13: Wi-Fi Rx sensitivity

Wi-Fi (CH 6)	Modulation	Data Rates	Sensibility (dBm)
b	BPSK	1 Mbps	-97
	QPSK	2 Mbps	-93
	CCK	5.5 Mbps	-92
	CCK	11 Mbps	-89
g	BPSK	6 Mbps	-92
	BPSK	9 Mbps	-91
	QPSK	12 Mbps	-90
	QPSK	18 Mbps	-87
	16 QAM	24 Mbps	-84
	16 QAM	36 Mbps	-81
	64 QAM	48 Mbps	-76
	64 QAM	54 Mbps	-75
n	BPSK	MCS0_20	-92
	QPSK	MCS1_20	-89
	QPSK	MCS2_20	-87
	16 QAM	MCS3_20	-84
	16 QAM	MCS4_20	-80
	64 QAM	MCS5_20	-76
	64 QAM	MCS6_20	-74
	64 QAM	MCS7_20	-72

6.4. BLE Rx Sensitivity

BLE Rx sensitivity at RF pad @ 25 °C.

Table 14: BLE Rx sensitivity

Packet Type	Rx sensibility (dBm)
LE 1M	-97
LE 2M	-95

6.5. General Purpose I/O

The module has 6 GPIO's which can be configured as input/output. They also have Alternate Functions.

Table 15: General Purpose I/O

GPIO Number	Alternate Function1 - I2C	Alternate Function2 - 1bit mode SDIO
IO1	I2C_SCL (I2C Clock)	SD_CMD (SD Command)
IO2	I2C_SDA (I2C Data)	SD_CLK (SD Clock)
IO3		SD_D0 (SD Data 0)
IO4	I2S_MCLK (I2S MCLK)	
IO5		
IO6		

6.6. Power Consumption

6.6.1. Average Power Consumption Levels

Table 16: Module power consumption in different states

Power Consumption	Typical Average (mA)
Standby	0,003
Idle (Radio OFF, UART ON)	14,3
Deep Sleep (Radio OFF) (no Wi-Fi Association)	0,04
Deep Sleep (Radio ON) (with Wi-Fi Association)	1,43
DTIM=1	1,01
DTIM=3	0,597
DTIM=10	0,203
BLE RX (peak current, connected to BT NW)	53
BLE TX (at 8dBm Tx @1Mbps)	109
Wi-Fi RX (continuous)	58

6.6.2. WLAN Continuous Tx Power consumption

Table 17: WLAN Continuous Tx Power consumption

Wi-Fi 2G4 / CH 6 Standard 802.11x	Modulation	Data Rates	RF Output (dBm)	Current mA@3.3V
b	BPSK	1 Mbps	18.0	265
b	QPSK	2 Mbps	18.0	261
b	CCK	5.5 Mbps	18.0	256
b	CCK	11 Mbps	18.0	248
g	BPSK	6 Mbps	18.0	245
g	BPSK	9 Mbps	17.0	239
g	QPSK	12 Mbps	17.0	225
g	QPSK	18 Mbps	16.5	212
g	16 QAM	24 Mbps	16.5	205
g	16 QAM	36 Mbps	16.0	185
g	64 QAM	48 Mbps	16.0	177
g	64 QAM	54 Mbps	16.0	173
n	BPSK	MCS0_20	17.0	231
n	QPSK	MCS1_20	16.0	209
n	QPSK	MCS2_20	17.0	201
n	16 QAM	MCS3_20	15.5	191
n	16 QAM	MCS4_20	15.5	181
n	64 QAM	MCS5_20	15.0	169
n	64 QAM	MCS6_20	15.0	165
n	64 QAM	MCS7_20	15.0	163
n	BPSK	MCS0_40	16.0	209
n	QPSK	MCS1_40	15.0	188
n	QPSK	MCS2_40	15.0	178
n	16QAM	MCS3_40	14.5	167
n	16QAM	MCS4_40	14.5	155
n	64QAM	MCS5_40	14.0	146
n	64QUAM	MCS6_40	14.0	142
n	64QAM	MCS7_40	14.0	139

Danger: The equipment must be supplied by an external limited power source in compliance with clause 2.5 of the standard EN 60950-1.

6.7. Pad Layout

The Pads layout for both (WE310F5-I and WE310F5-P) the versions of the module is the same, the only difference is the dimension of the RAW PCB due to the on-board antenna on the WE310F5-I version of the module

The following figure shows the pads layout configuration for the module:

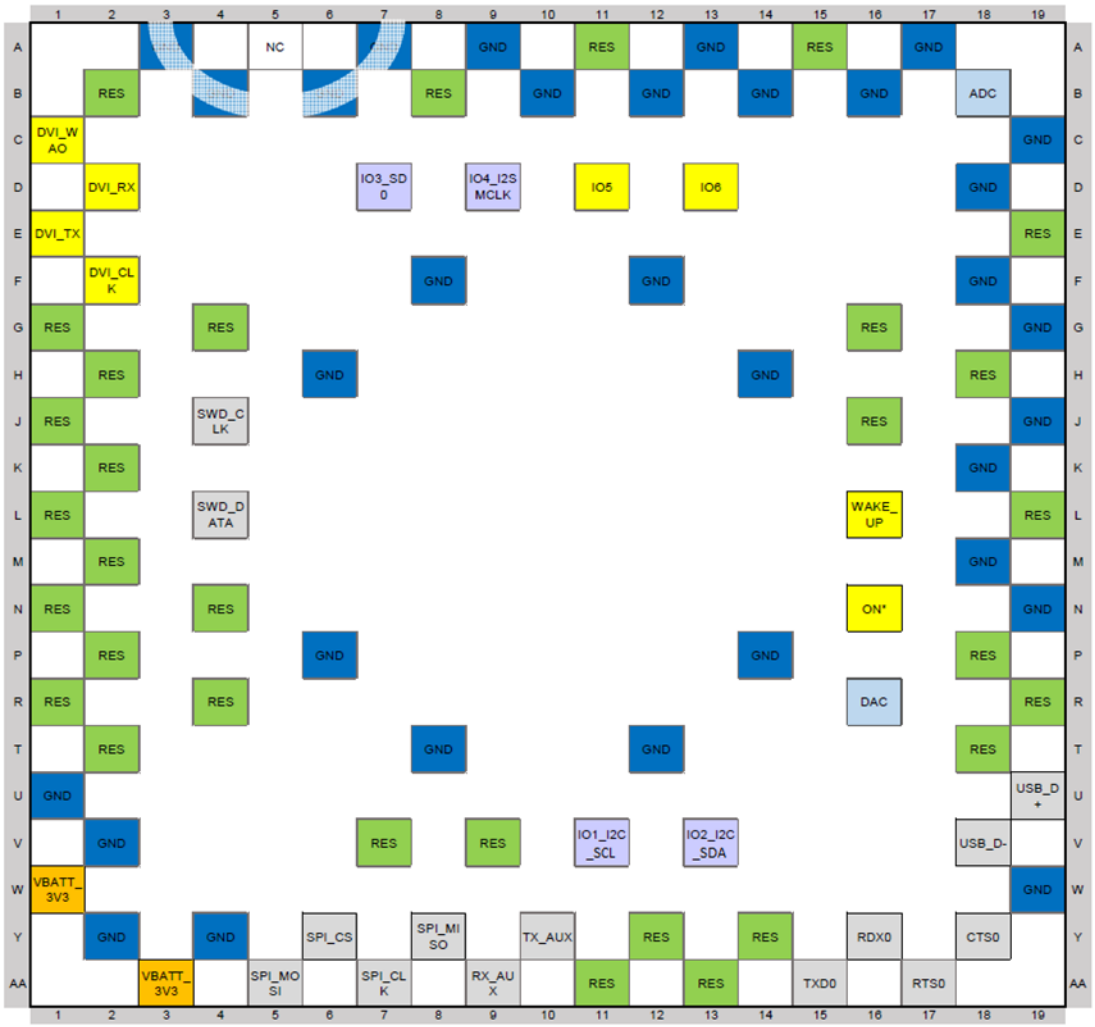

Figure 5:Telit WE310F5-I Pads Layout Top View

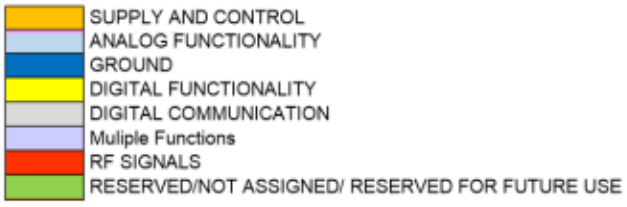

Figure 6:Telit WE310F5-I PIN Out Legend

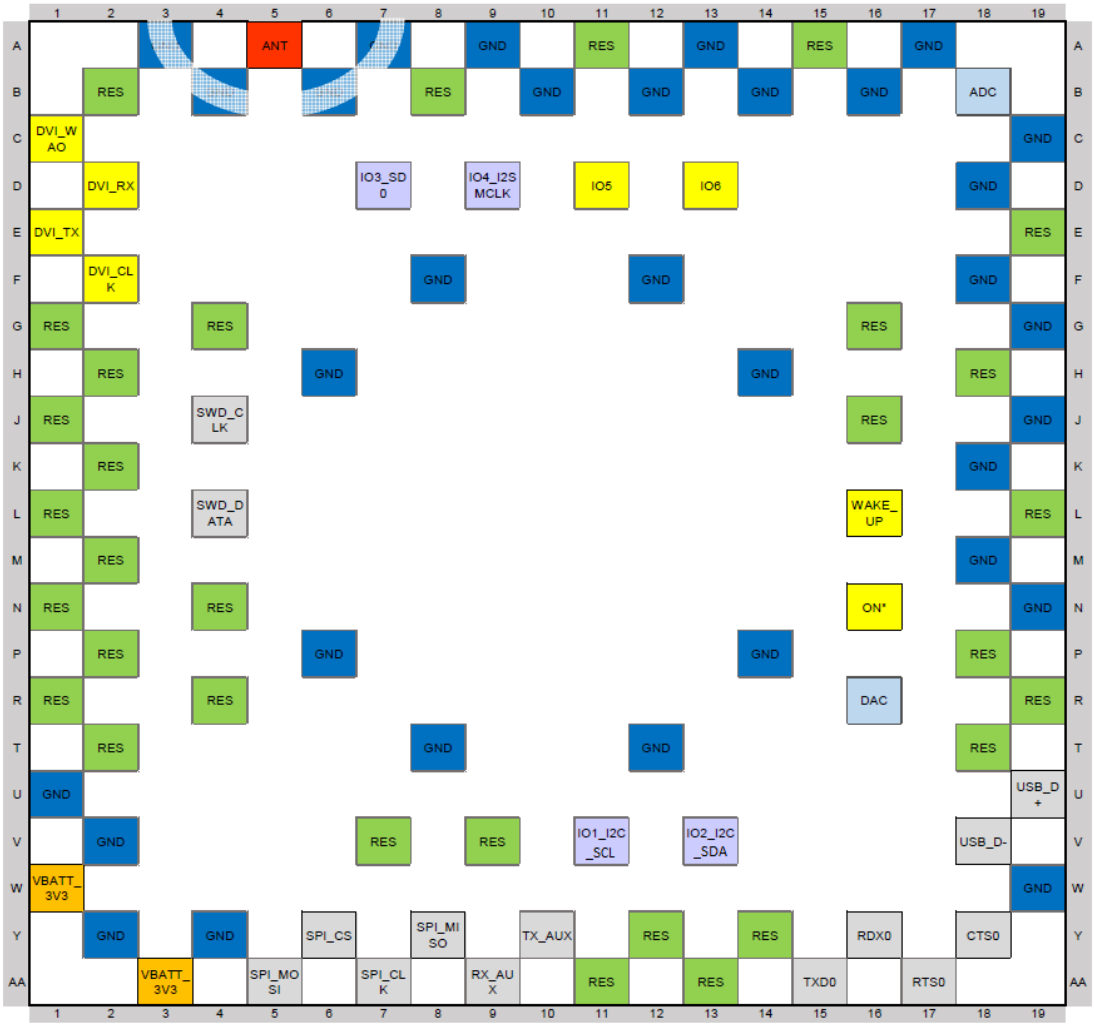

Figure 7:Telit WE310F5-P Pads Layout Top View

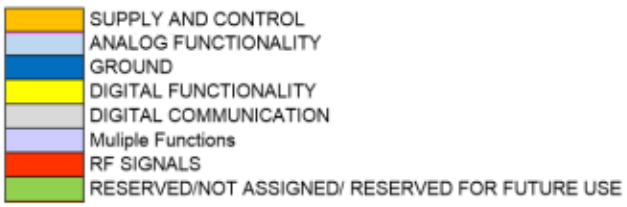

Figure 8:Telit WE310F5-P PIN Out Legend

7. DESIGN GUIDELINES

7.1. General Digital Interface Recommendations

There are two UART's in WE310F5, intended to be used as explained below.

1. UART0 is for AT commands and responses for application use. Baud rate supported 300 ~ 921600 (default baud 115200). HW flow control is supported.
2. AUX UART (also referred to as UART1) is for flashing, RF Tests, and debug logs. Do not use this port for AT commands and response. Baud rate is fixed at 115200, doesn't support HW flow control.
3. WE310F5 module is shipped with the default firmware, developers often need to flash the module during development. We recommend having an option for flashing the module. This is a generic requirement during production and certification. TX_AUX pin (Y10) is the Program/Run mode pin. Make this pin LOW to place the WE310F5 in program mode.

A sample circuit is shown below:

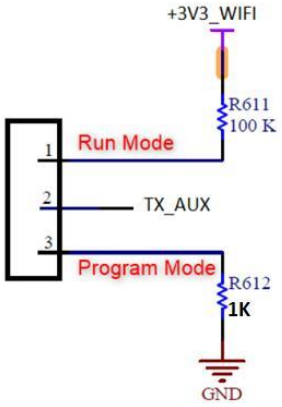

Figure 9:Telit WE310F5 Sample Circuit

A voltage translator must be used if the components are interfacing with Telit components have digital signals with higher I/O interface voltage than the WE310F5-I/P module.

Using voltage translator components in your design makes the system ready for operation at the full VIO voltage range, 3.3V to system I/O voltage. However, using resistor divider and/or emitter follower circuits, as voltage translators does not protect the module against latch-up. Furthermore, you cannot guarantee a constant voltage on the divider net.

The use of open collector buffers or bi-directional voltage level translators with unidirectional signals is correct, but they suffer from some RF noise and they are dependent on Pull-Up/Downs in the two sides of the voltage translator.

Some translators operate with different power ranges on the two sides: pay attention to the direction in this case.

In general, we recommend unidirectional level shifters but if bi-directional buffers are preferred, please considering those that require external PU/PD instead of having embedded PU/PD circuitry. Some brands that we recommend:

Texas Instruments TXS series

NXS NVT200x series

If the system includes a cellular module, consider adding some bypass capacitors to the supply lines of the voltage level translators to protect RF signals.

For bypass use 33pF for the 0402 packages or 56pF when are you going to use 0201. For example, SN74AVC2T245, SN74AVC4T774, or SN74LVC2T45, for 5V signals.

Moreover, while using level shifters for better testability, it is recommended to use those having OE pins. Test pulling the "EN" lines of the level shifts with the addition of a 10K resistor to GND or VCC, depending on the level shifter used. This will create access points that would put shifts in tri-state and can be conveniently used for testing and firmware updates originating from external serial ports such as a PC.

It is recommended to connect the WE310F5-I/P ON* (N16 pin) to control the Enable pin of the level shifter, in this way a tri-state will be guarantee during BOOT.

7.2. Power supply design guidelines

We recommend adding an external EMI filter to improve the quality of the power supply especially when the module will be embedded with other technologies, (i.e. Cellular).

The pi-greca filter composed of ferrite bead and 10pF capacitors (C2, C3) is used to provide a high impedance value for high-frequency signals, while the 100uF and 22uF capacitors (C1, C5, and C4) are used to bypass low frequencies from switching regulator circuit and to provide a supply tank for high current absorption

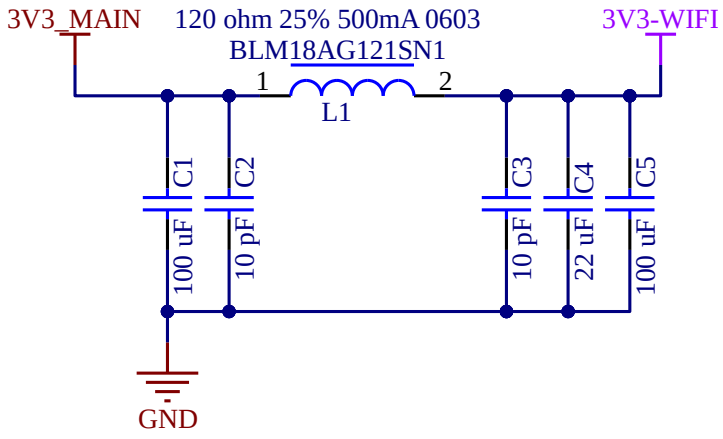

Figure 10:Telit WE310F5 EMI Filter Example Circuit

The figure above shows an example circuit with the minimum allowable capacitor values.

Danger: Abrupt Power Cut may corrupt the modem's memory.

Use it only when no other option, like RESET or Power Shutdown, is not available.

Table 18: Power Supply Requirements

Power Supply	Value
Nominal Supply Voltage	3.8 V
Operating Voltage Range	3.40 V ÷ 4.40 V
Extreme Voltage Range	3.00 V ÷ 4.75 V

Note/Tip: The Extreme Operating Voltage Range MUST never be exceeded.

If the power supply is not properly designed, it can cause a large voltage drop.

The hardware shutdown voltage of the module is 3.0V. If the voltage drops below 3.0V, the module hardware will be shut down.

7.3. Bypass Capacitors

To improve the harmonic filtering, we recommend adding bypass capacitors, close to:

- Power Sources and signals on input-output connectors
- At power supply output PADs.
- At component's power supply input PADs (even if shielded).
- Diodes in forwarding conduction, like LEDs, on the anode and/or cathodes if not directly tied to a power net.
- Transistor bases, mainly for bipolar ones, phototransistors, and opto-isolator
- Analog microphone pads.
- Operational Amplifiers Inputs and supplies.

The bypass capacitors should have a self-resonant frequency close to the frequency generated on your board or on transmitted from the boards that will operate in the same environment in which your board operates.

For example, to effectively filter the Wi-Fi RF bands, these small signal capacitors must have a self-resonant (SRF) at about 2.4GHz. Example capacitor values, depending on manufacture and its mechanical dimensions should be around 10pF, in general by reducing the packaging size you will need to increase the capacitance value. Please check carefully the datasheet to find the proper component suitable for this purpose.

Another example is for GSM, in general, you can use 33pF 0402 or 56pF 0201

7.4. General Design Rules

The WE310F5-I has an embedded ceramic antenna on board. To preserve the bandwidth, keep attention to not place any copper or mechanic component in front or close to the ceramic antenna.

We recommend module placement as shown in the figure below:

- **Main board Size : 50mm X 50mm**
- **Recommend location**

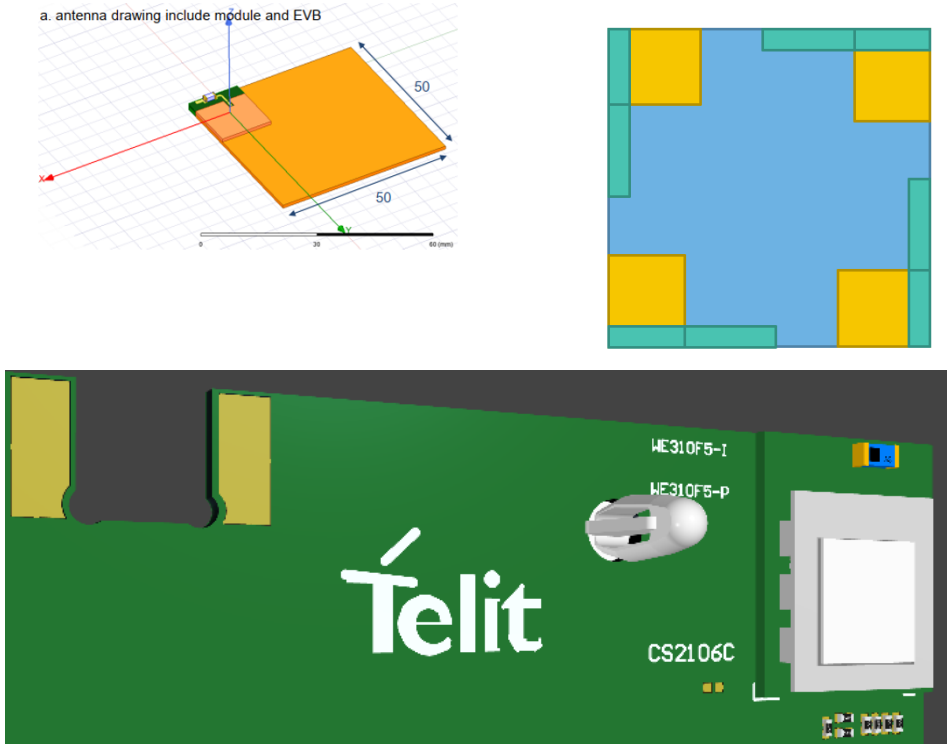

Figure 11: WE310F5-I Placement Example

For the WE310F5-I version the antenna is placed directly on the board, so you will need to leave a copper keep-out area as shown below:

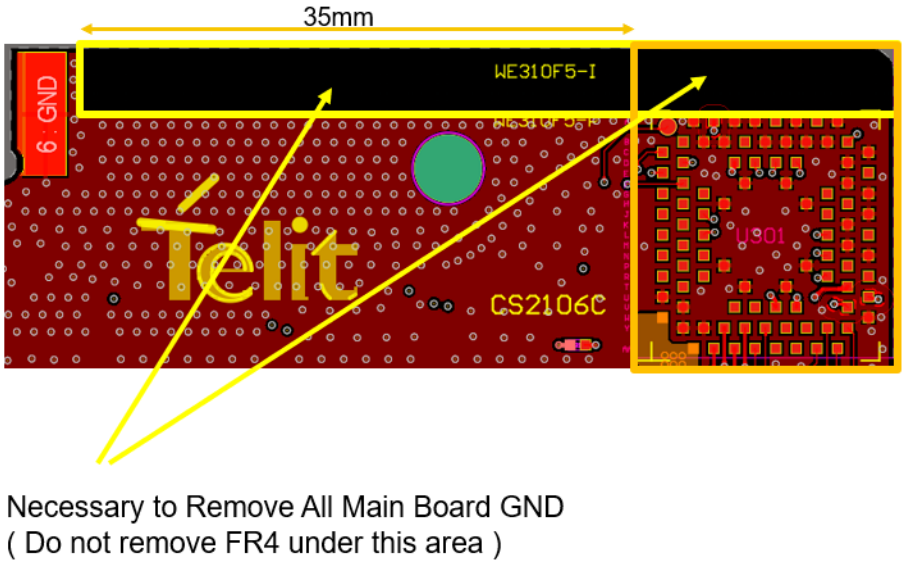

Figure 12: WE310F5-I Placement Example showing no copper in any layer of the board.

For WE310F5-P you will need to use an external antenna connected to the antenna pad of the module, such as an SMA connector as shown in the figure below.

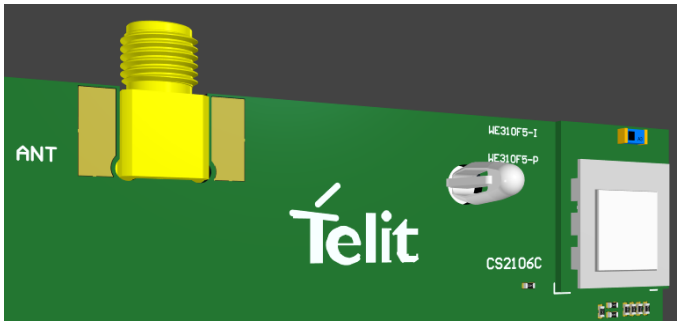

Figure 13: WE310F5-P Placement Example

In this case, considering the position of the external antenna with respect to other boards is very important. the conductive planes close to the antenna can modify the impedance seen by the antenna or detune it.

- The WE310F5-P module provides a 50Ω antenna pad, which needs to be routed to the antenna connector (or the integrated antenna) with a transmission line
- Please keep as close as possible to 50Ω impedance in the RF track, including the RF Pad.
- To avoid step impedance, try to track RF trace as much equal as possible to the pad with the matching components

Figure 14: RF Track Example

- To have a good impedance control consider using a Grounded coplanar waveguide structure (G-CPW) line.

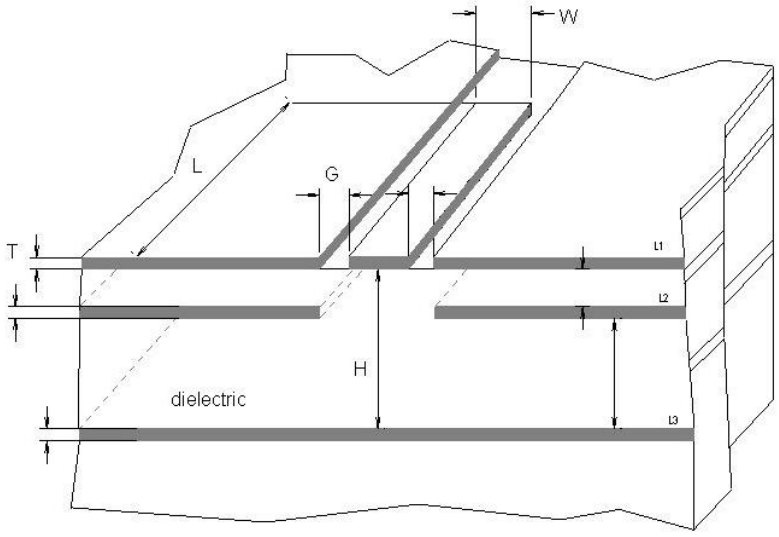

Figure 15: Coplanar Waveguide Dimensioning Example

The final dimensions depend on the use of stack-up. While the WE310F5-I is already tuned to the embedded antenna, the WE310F5-P version needs to be tuned in relationship to the stack-up used.

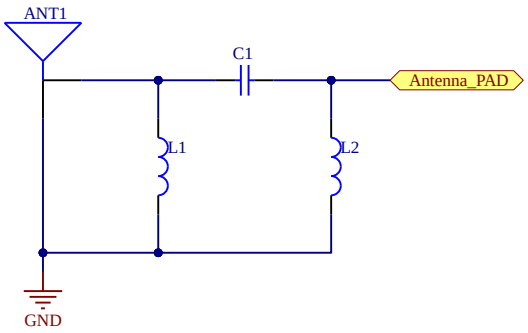

Figure 16: Minimal RF Matching Network Circuitry

A possible network topology is seen in the above figure and it consists of three passive components.

To reuse Telit's FCC certification for our module, the antenna on the application board shall have a gain equal or lower to the one recommended by Telit, the separation distance between the user and/or bystander and the device's radiating element must be greater than 20cm and no other radiating element must be present inside the application closer than 20cm to our antennas. However, a separate test for any other radiating element could be necessary.

For an external antenna, it is recommended to use xxx antenna from xxx which is a WLAN, complete with antenna characteristics.

7.5. Audio considerations

The digital audio data interface supports I2S. Since many external processors and applications have fast transient signals, it is recommended to add an RC filter on all DVI lines (R~220hm and C~10nF). If the DVI lines, I2S, are run on external layers it is possible that RF will disturb the lines, to resolve this, add in parallel, to 10nF, another capacitor of about 10pF to 33pF.

7.6. Audio considerations

Since, components and PCBs are getting smaller while the component's density increases, another problem that becomes important is heat dissipation.

For that reason, pay special attention to the PCB stack-up and component placement. The following PCB design rules will help RF immunity and improve heat dissipation.

1. Use at least six layers of PCB technology.
2. Layer2 and Layer4 should be mainly ground.
3. On top of Layer1 and at the bottom of Layer6, place mainly ground plane interrupted just by component pads and RF antenna tracks.

4. Minimum tracks connecting Layer3 to Layer5. This is done to avoid ground interruption and its heat dissipation.
5. Use Layer3 and Layer5 only for signals, where power lines are wider tracks and surrounded by ground to reduce the risk of crosstalk with other signals.
6. Use one layer for horizontal lines only, and another one for vertical lines. Fill the remaining space with the ground.
7. Use several vias to connect all ground planes and areas in all layers with possible through-hole drills.
8. Place warmer components on the PCB side facing up and do not place anything near them, leaving space for air.
9. If it is a closed application, consider opening holes on the top and bottom of the cover for ventilation.

It is recommended to use 4 layers only if the number of interconnection gives you the possibility to route them on layer2 and layer3 in a way that power lines and signals lines do not intersect, and the module is operating continuously so the heat dissipation is not a must. All the rest suggestions described above must be fulfilling.

The audio, USB, and ADC lines must be routed avoiding intersection with any other signal.

Top and Bottom layers should be mainly a ground plane interrupted just by the component's pads, vias, and RF tracks. Connect all ground areas avoiding isolated islands with several vias. In this way, the signal tracks are more protected from picking up RF due to the Faraday-Cage effect. Long exposed tracks can easily pick up RF power and especially in your case with many RF power sources you can generate high-frequency intermodulation harmonics that the same exposed tracks can then irradiate very efficiently.

The PCB outline should be surrounded by GND vias interconnected from TOP to Bottom.

We also recommend filling the free space in the inner layers with the ground.

Pay attention to interconnect all the ground areas or planes to guarantee a strong equipotential node. Remove dead copper areas and net antennas tracks or vias.

It is recommended to bury in inner layers:

1. Analog or digital audio lines.
2. Memory address and data bus.
3. Fast digital signals like SPI or SDIO, clocks, quartz.
4. USB and long serial.

The following figure shows an example of fast signals track routing. In this example, the tracks are routed in an inner layer and surrounded by GND and GND vias to be shielded. If possible, try to shield with GND areas the above and below areas.

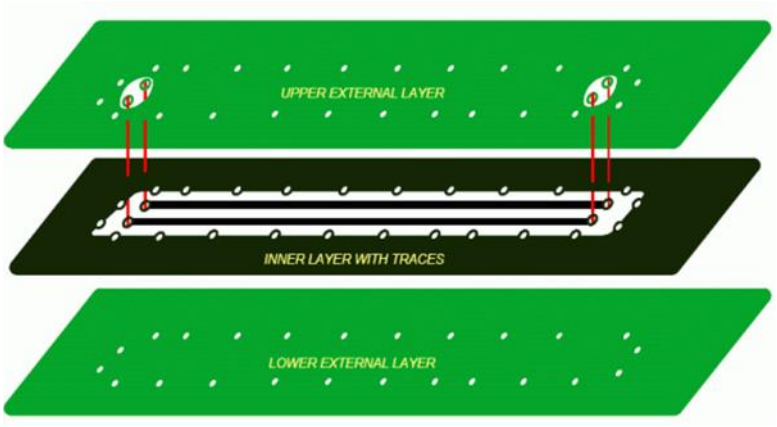

Figure 17: Layout Example for FAST Digital Lines

Lines to resolve this, add in parallel, to 10nF, another capacitor of about 10pF to 33pF.

8. MECHANICAL DESIGN

The following is the Top and bottom view of the Telit WE310F5-I module

8.1. WE310F5-I

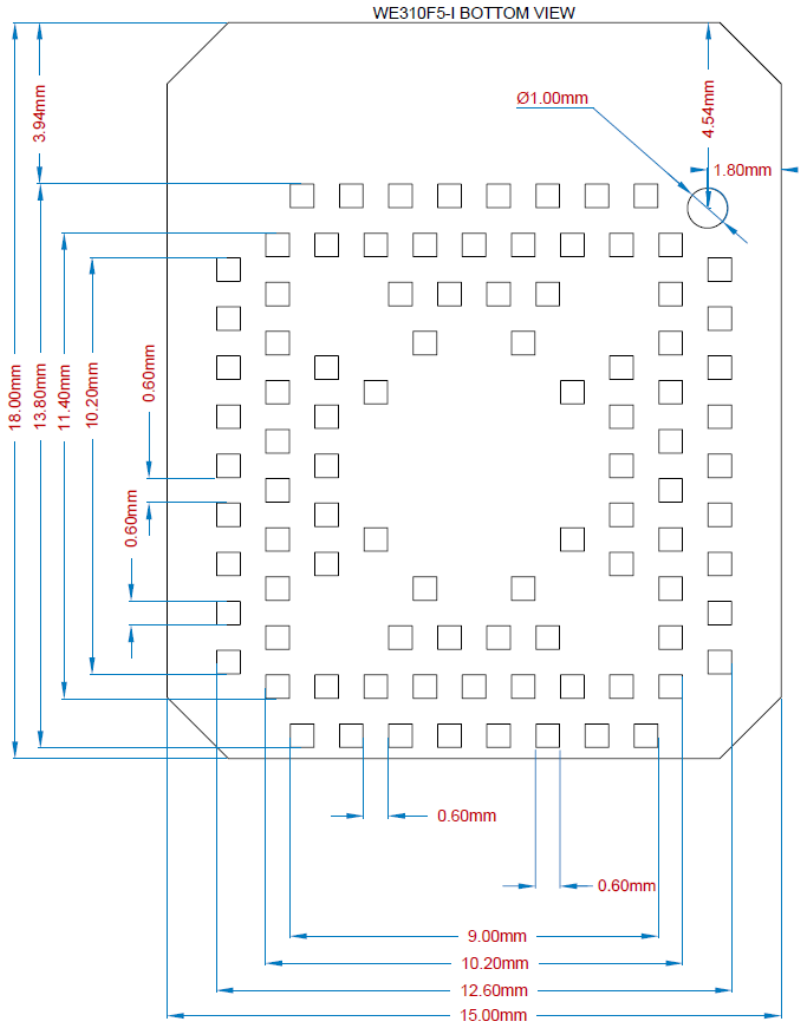

Figure 18: WE310F5-I bottom view

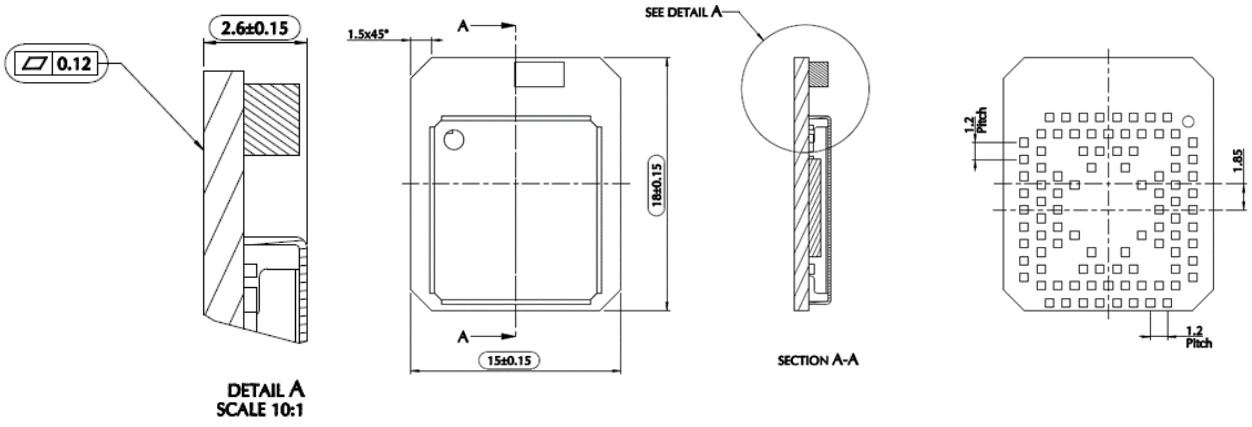

Figure 19: WE310F5-I side view and mechanical design

8.2. WE310F5-P

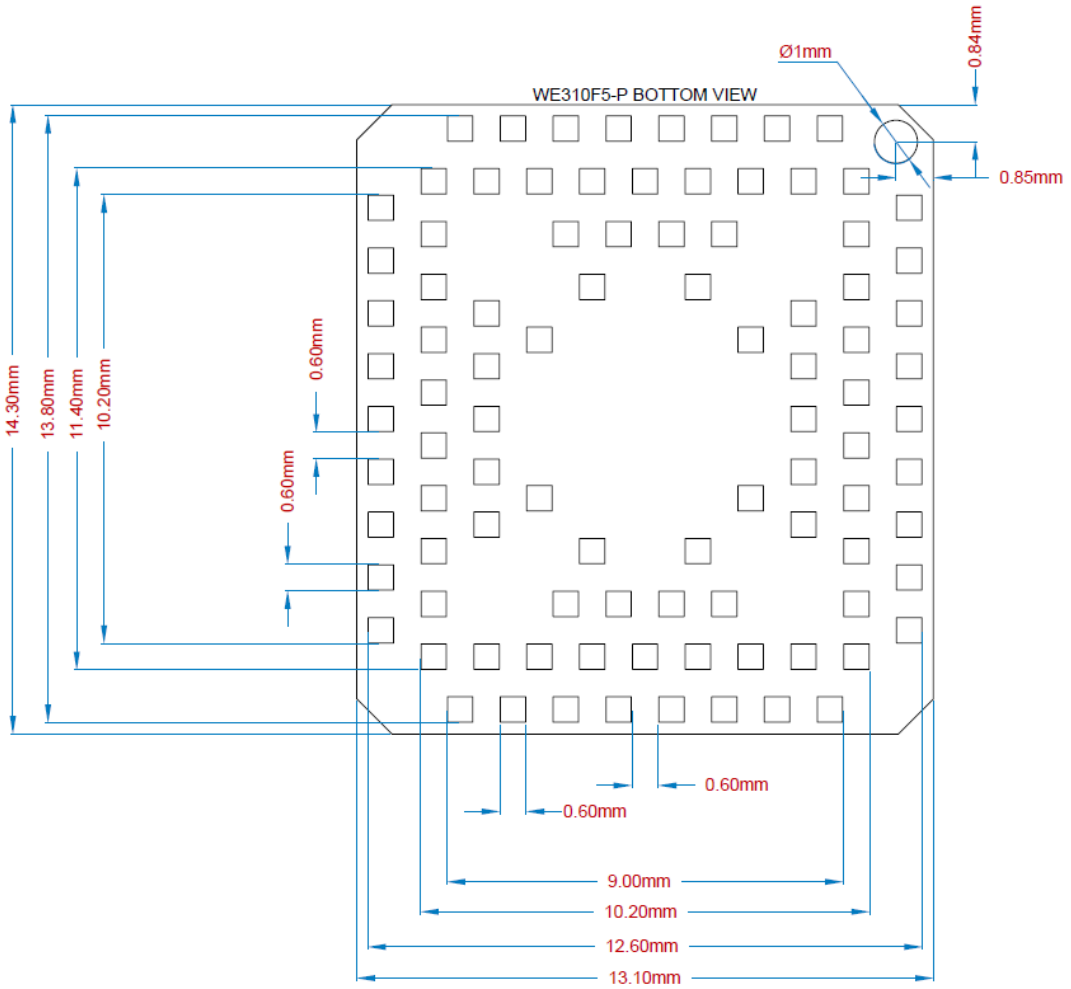

Figure 20: WE310F5-I bottom view

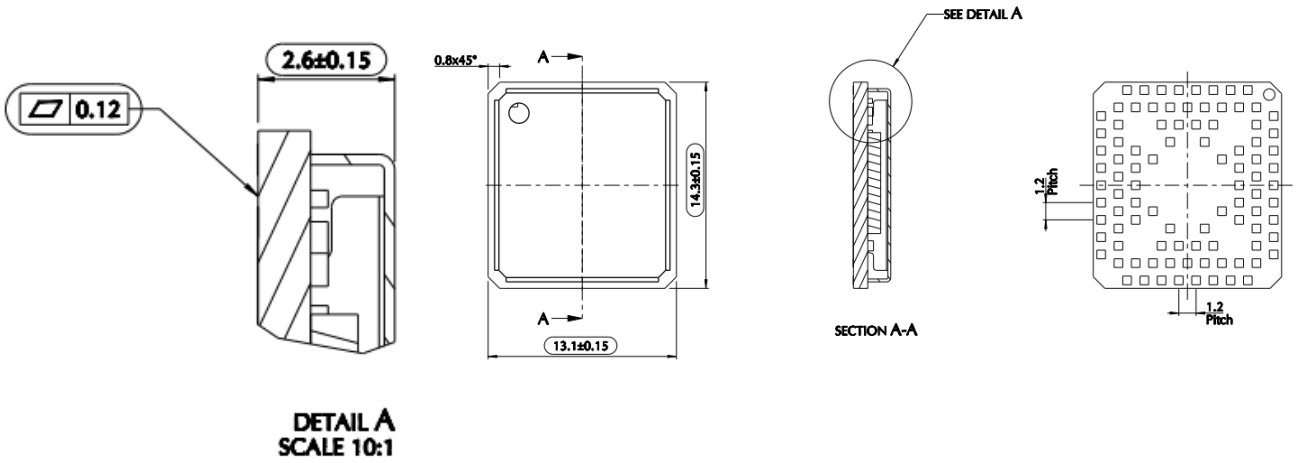

Figure 21: WE310F5-P side view and mechanical design

8.3. PCB Pad Design

For the solder pads, it is recommended to use Non-Solder Mask Defined pad (NSMD) on the PCB.

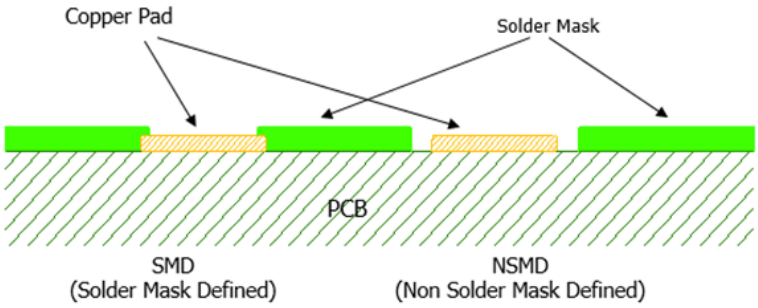

Figure 22: SMD and NSMD Pad

8.4. PCB Pad Dimensions

It is not recommended to place via or micro-via not covered by the solder resist in an area of 0.3 mm around the pads unless it carries the same signal of the pad itself as shown below.

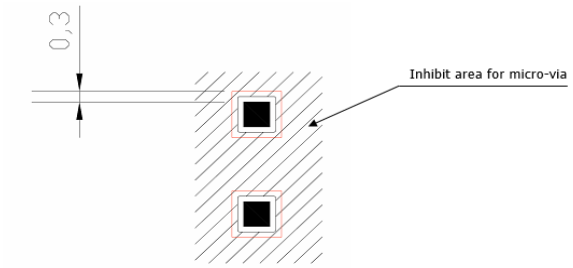

Figure 23: Inhibit Area for Not Solder Covered Vias

The holes in the pad are allowed only for blind holes and not for through holes. Table 19: shows the recommended PCB pad surfaces.

Table 19: PCB Finishing Recommendation

Finish	Layer thickness [µm]	Properties
Electro-less Ni / Immersion Au	3 –7 / 0.03 – 0.15	Good solderability protection, high shear force values

The PCB must be able to resist the higher temperatures which can occur during the lead-free process. This issue should be discussed with the PCB supplier. Generally, the wettability of tin-lead solder paste on the described surface plating is better compared to lead-free solder paste.

It is not necessary to panel the application PCB. However, it is recommended to use milled contours and predrilled board breakouts; scoring or v-cut solutions are NOT recommended.

8.5. Stencil

The Stencil's aperture layout can be the same as the recommended footprint (1:1). It is recommended to use a stencil foil with a thickness ≥ 120 µm.

8.6. Solder Paste

Table 20: Recommended Solder Paste Type

	Lead-free
Solder paste	Sn/Ag/Cu

To avoid or minimize the cleaning efforts after assembly, it is recommended to use a "no-clean" solder paste.

8.7. PCB Pad Dimensions

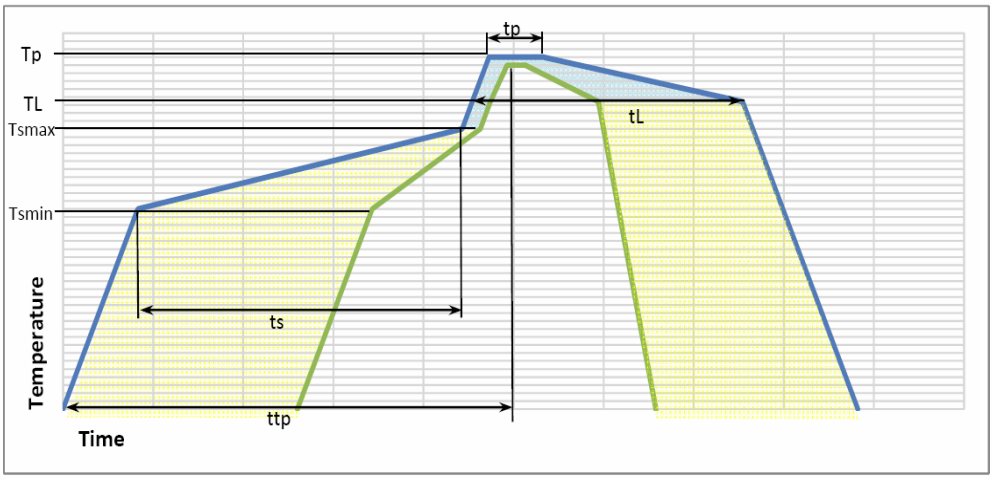

Figure 24: Solder Reflow Profile

Table 21: Solder Reflow Specification

Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_p)	3 °C/second max.
Preheat • Temperature Min. (T_{smin}) • Temperature Max. (T_{smax}) • Time (min to max) (t_s)	 150 °C 200 °C 60-180 seconds
T_{smax} to T_L • Ramp-up rate	 3 °C/second max
Time maintained above • Temperature (T_L) • Time (t_L)	 217 °C 60-150 seconds
Peak temperature (T_p)	245 +0/-5 °C
Time within 5 °C of the actual peak	10-30 seconds

Profile Feature	Pb-Free Assembly
temperature (t_p)	
Ramp-down rate	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

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

Danger: The WE310F5-I/P module withstands only one reflow process.

The above solder reflow profile represents the typical SAC reflow limits and does not guarantee adequate adherence of the module to the customer application throughout the temperature range. The customer must optimize the reflow profile depending on the overall system considering such factors as thermal mass and warpage.

9. PACKAGING

9.1. Tray

The WE310F5-I/P modules are packaged on trays of 50 pieces each when small quantities are required (i.e. for test and evaluation purposes).

These trays are not designed for use in SMT processes for pick and place handling.

The following is the packaging process:

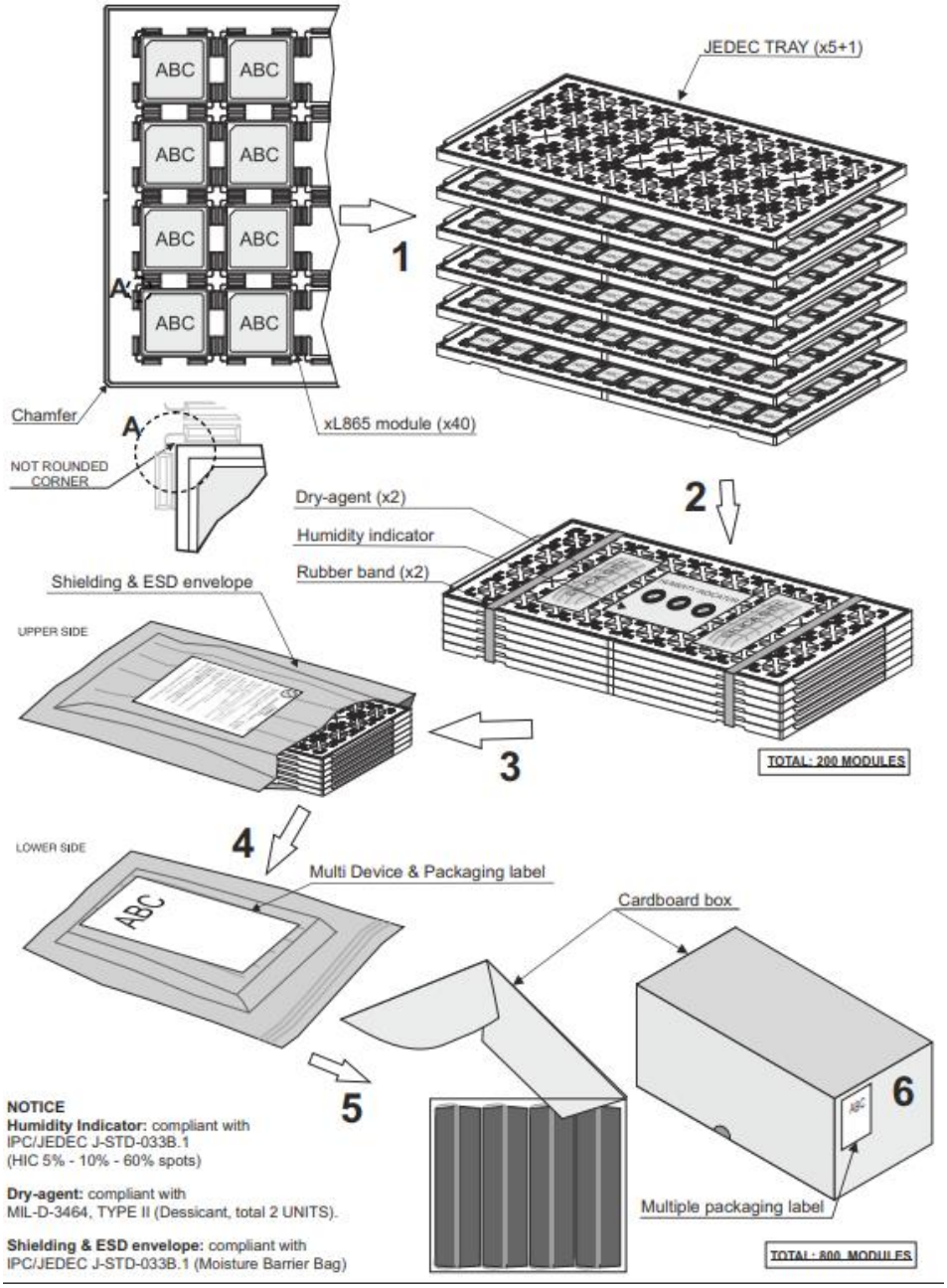

Figure 25: WE310F5-I/P Packaging example

Danger: The maximum temperature for these trays shall not exceed 65°C

9.2. Moisture sensitivity

The WE310F5-I/P module is classified as a LEVEL 3 moisture-sensitive device following IPC/JEDEC J-STD-020.

Moreover, the customer must take care of the following conditions:

a. The shelf life of the product inside the dry bag is 12 months starting from the bag seal date when stored in a non-condensing atmospheric environment of < 40°C and < 90% relative humidity (RH).
b. Environmental condition during the production: <= 30°C / 60% RH according to IPC/JEDEC J-STD-033B.
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-033B paragraph §5.2" is respected.
d. Baking is required if conditions b) or c) are not respected
e. Baking is required if the humidity indicator inside the bag indicates 10% RH or more.

10. CONFORMITY ASSESSMENT ISSUES

10.1. Approvals summary

Table 22: Approvals summary

Module	EU RED	US FCC	CA ISED	BR ANATEL	JP JRF&JTBL	CH CCC
XX123Z4-W1	Yes	Yes	Yes	-	-	Yes
XX123Z4-WW	Yes	Yes	Yes	Yes	Yes	TBD
XX123Z4-WWV	Yes	Yes	Yes	-	-	TBD

10.2. RED approval

10.2.1. RED Declaration of Conformity

Hereby, Telit Communications S.p.A declares that the XX123Z4-W1, XX123Z4-WW, and XX123Z4-WWV Modules comply with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: http://www.telit.com/red

Text of 2014/53/EU Directive (RED) can be found here:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0053

10.2.2. Antennas

This radio transmitter has been approved under RED to operate with the antenna types listed below with the maximum permissible gain indicated. The usage of a different antenna in the final hosting device may need a new assessment of host conformity to RED.

Table 23: RED Antenna Type

Model	Antenna Type
XX123Z4-W1	Omnidirectional Antenna Gain 2.14 dBi
XX123Z4-WW	
XX123Z4-WWV	

Table 24: Max Gain for RED

Max Gain for RED (dBi)			
Band	XX123Z4-W1	XX123Z4-WW	XX123Z4-WWV

Max Gain for RED (dBi)			
GSM 900	---	---	TBD
DCS 1800	---	---	TBD
GPRS/EGPRS 900	---	5.47	5.47
GPRS/EGPRS 1800	---	9.34	9.34
FDD 1	14.84	11.84	11.84
FDD 3	14.33	11.33	11.33
FDD 8	11.45	8.45	8.45
FDD 20	11.20	8.20	8.20
FDD 28	10.47	7.47	7.47

10.3. FCC and ISED approval/*FCC et ISDE approbation*

10.3.1. FCC Certificate

The FCC Certificate is available here:

https://www.fcc.gov/oet/ea/fccid

10.3.2. ISED approval/*ISDE approbation*

The ISED Certificate is available here /*Le certificat ISDE est disponible ici*:

https://smssgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1&lang=en

10.3.3. Applicable FCC and ISED rules /*Liste des règles FCC et ISDE applicable*

Table 25: Applicable FCC and ISED rules

Model *Modèle*	Applicable FCC Rules	Applicable ISED Rules *Règles ISDE applicables*
XX123Z4-W1	47 CFR Part 2, 22, 24, 27, 90	RSS: 132 Issue3, 133 Issue 6, 130 Issue 2, 139 Issue 3; RSS-Gen Issue 5
XX123Z4-WW		
XX123Z4-WWV		

10.3.4. FCC and ISED Regulatory notices/*Avis réglementaires de FCC et ISDE*

Modification statement / *Déclaration de modification*

Telit has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

Telit n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Interference statement / *Déclaration d'interférence*

This device complies with Part 15 of the FCC Rules and 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.

Wireless notice / *Wireless avis*

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The antenna should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur. L'antenne doit être installée de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps.

FCC Class B digital device notice (FCC only)

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 following 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 taking 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.

CAN ICES-3 (B) / NMB-3 (B) (ISED only) / *(ISDE seulement)*

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

10.3.5. Antennas /Antennes

FCC

This radio transmitter has been approved by FCC and ISED to operate with the antenna types listed below with the maximum permissible gain 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.

Table 26: FCC Antenna Type

Model	Antenna Type
XX123Z4-W1	Omnidirectional Antenna Gain 2.14 dBi
XX123Z4-WW	
XX123Z4-WWV	

Table 27: Max Gain for FCC (dBi)

Max Gain for FCC (dBi)			
Band	XX123Z4-W1	XX123Z4-WW	XX123Z4-WWV
GSM 850	---	---	8.44
GSM 1900	---	---	10.04
GPRS/EGPRS 850	---	6.93	6.93
GPRS/EGPRS 1900	---	10.42	10.42
FDD 2	11.0	12.01	12.01
FDD 4	8.0	12.01	12.01

Max Gain for FCC (dBi)			
FDD 5	12.4	9.41	9.41
FDD 12	11.6	8.70	8.70
FDD 13	12.1	9.16	9.16
FDD 25	11.0	12.01	12.01
FDD 26	12.3	9.36	9.36
FDD 66	8.0	12.01	12.01
FDD 71	11.4	11.47	11.47
FDD 85	11.6	8.69	8.69

ISED / ISDE

This radio transmitter has been approved by ISED to operate with the antenna types listed below with the maximum permissible gain 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.

Le présent émetteur radio a été approuvé par ISDE pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Table 28: ISED Antenna Type

Model *Modèle*	Antenna Type *Type d'Antenne*
XX123Z4-W1	Omnidirectional Antenna Gain 2.14 dBi *Omnidirectionelle* *Gain de l'antenne 2.14 dBi*
XX123Z4-WW	
XX123Z4-WWV	

Table 29: Gain maximum for ISED (dBi)

Gain maximum pour ISED (dBi) / *Gain maximum pour ISDE (dBi)*			
Bande	XX123Z4-W1	XX123Z4-WW	XX123Z4-WWV
GSM 850			5.15
GSM 1900			10.04
GPRS/EGPRS 850	---	3.64	3.64
GPRS/EGPRS 1900	---	5.13	5.13
FDD 2	11.0	8.52	8.52
FDD 4	8.0	8.29	8.29
FDD 5	9.1	6.12	6.12
FDD 12	8.6	5.63	5.63

Gain maximum pour ISED (dBi) / *Gain maximum pour ISDE (dBi)*			
FDD 13	8.9	5.95	5.95
FDD 25	11.0	8.52	8.52
FDD 26	9.0	6.09	6.09
FDD 66	8.0	8.29	8.29
FDD 71	8.4	8.48	8.48
FDD 85	8.6	5.63	5.63

10.3.6. FCC Label and compliance information

The product has an FCC ID label on the device itself. Also, the OEM host end product manufacturer will be informed to display a label referring to the enclosed module The exterior label will read as follows: "Contains Transmitter Module FCC ID: RI7 XX123Z4W1" or "Contains FCC ID: RI7XX123Z4W1" for XX123Z4-W1 and: "Contains Transmitter Module FCC ID: RI7XX123Z4WW" or "Contains FCC ID: RI7XX123Z4WW" for XX123Z4-WW and XX123Z4-WWV

Below list of all the models and related FCC ID:

Table 30: FCC ID

Model	FCC ID
XX123Z4-W1	RI7XX123Z4W1
XX123Z4-WW	RI7XX123Z4WW
XX123Z4-WWV	

10.3.7. ISED Label and compliance information/*ISED Étiquette et informations de conformité*

The host product shall be properly labeled to identify the modules within the host product.

The ISED certification label of a module shall be visible at all times when installed in the host product; otherwise, the host product must be labeled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:

Contains IC: XXXXXX-YYYYYYYYYY

In this case, XXXXXX-YYYYYYYYYY is the module's certification number.

Le produit hôte devra être correctement étiqueté, de façon à permettre l'identification des modules qui s'y trouvent.

L'étiquette d'homologation d'un module d'ISDE devra être apposée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'ISDE, précédé

du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit :

Contient IC : XXXXXX-YYYYYYYYYY

Dans ce cas, XXXXXX-YYYYYYYYYY est le numéro d'homologation du module.

Table 31: ISED Certification Number

Model *Modèle*	ISED Certification Number *Num. de certification ISDE*
XX123Z4-W1	5131A-XX123Z4W1
XX123Z4-WW	5131A- XX123Z4WW
XX123Z4-WWV	

10.3.8. Information on test modes and additional testing requirements / *Informations sur les modes de test et les exigences de test supplémentaires*

The module has been evaluated in mobile stand-alone conditions. For different operational conditions from a stand-alone modular transmitter in a host (multiple, simultaneously transmitting modules or other transmitters in a host), additional testing may be required (collocation, retesting…)

If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

Le module a été évalué dans des conditions autonomes mobiles. Pour différentes conditions de fonctionnement d'un émetteur modulaire autonome dans un hôte (plusieurs modules émettant simultanément ou d'autres émetteurs dans un hôte), des tests supplémentaires peuvent être nécessaires (colocalisation, retesting…)

Si ce module est destiné à être utilisé dans un appareil portable, vous êtes responsable de l'approbation séparée pour satisfaire aux exigences SAR de la FCC Partie 2.1093 et IC RSS-102.

10.3.9. FCC Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end product with an embedded module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

10.4. ANATEL Regulatory Notices

"Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados"

"This equipment is not entitled to protection against harmful interference and must not cause interference in duly authorized systems"

XX123Z4-WW, XX123Z4-WW, XX123Z4-WW Homologation #: 08566-20-02618

10.5. RoHS and REACH info

10.5.1. RoHS info

Any requests on information related to RoHS certifications can be addressed to *Chemical.Certifications@telit.com*.

10.5.2. REACH info

Any requests on information related to REACH certifications can be addressed to *Chemical.Certifications@telit.com*.

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11.3. Safety Recommendations

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

- It can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircraft, etc.
- There is a risk of explosions 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 mark 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 has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power-saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully 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 has to assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

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

https://ec.europa.eu/growth/sectors/electrical-engineering_en

12.GLOSSARY

Table 32: Acronym List

Acronym	Definition
TTSC	Telit Technical Support Centre
USB	Universal Serial Bus
HS	High Speed
DTE	Data Terminal Equipment
UMTS	Universal Mobile Telecommunication System
WCDMA	Wideband Code Division Multiple Access
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
UART	Universal Asynchronous Receiver Transmitter
HSIC	High Speed Inter Chip
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
ADC	Analog – Digital Converter
DAC	Digital – Analog Converter
I/O	Input Output
GPIO	General Purpose Input Output
CMOS	Complementary Metal – Oxide Semiconductor
MOSI	Master Output – Slave Input
MISO	Master Input – Slave Output
CLK	Clock
MRDY	Master Ready
SRDY	Slave Ready
CS	Chip Select
RTC	Real Time Clock
PCB	Printed Circuit Board
ESR	Equivalent Series Resistance
VSWR	Voltage Standing Wave Radio
VNA	Vector Network Analyzer

13.DOCUMENT HISTORY

Table 33: Document History

Revision	Date	Changes
14	2021-07-07	Migration to New document template. Update of figure in Design Guidelines.
13	2021-06-08	Updates in 4.1 Table
12	2021-04-07	4.1 Table updated, 7.1 updates info on Run mode/Program Mode.
11	2021-02-02	Updated Power consumption Table 14.
10	2021-01-21	Updated Section 11 FCC/IC compliance. Removed 15E in the List of applicable FCC rules. Added FCC and IC ID. Modified the antenna max gain from 2.5 to 2.3dBi
9	2020-03-12	Updated Power consumption Table 14.
8	2020-13-11	Updated WiFi Transmit Power table (Table n°9), and WLAN Continuous TX power Consumption table (Table n°15) after some software optimizations.
7	2020-10-09	Updated Figures 20 and 23, added ESD and SAR ADC characteristics, some general improvements, removed Preliminary Watermark.
6	2020-09-30	Pinout Figure 6 and Figure 7 updated (removed R-KEY).
5	2020-09-14	Pinout Figure 6 and Figure 7 updated.
4	2020-09-04	Pinout table fixed on debug port.
3	2020-09-04	Pinout and some figures.

2	2020-09-01	Updated Pinout figures, Addition of details to Table 7 General Power Consumption and Deleted figures - WE310F5-I Top View and WE310F5-P Top View.
1	2020-06-29	Update of SD card, Clock and Memory specification.
0	2020-05-27	First issue.

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