Telit Cinterion

ME310M1

Hardware Design Guide

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Technical Documentation

Contents

1 Applicability Table

Table 1: Applicability Table

Products
ME310M1-W1
ME310M1-W2

2 Introduction

2.1 Scope

This document introduces the Telit ME310M1 module and presents possible and recommended hardware implementations for the development of a product based on this module. All the features and solutions described in this document apply to all ME310M1 variants listed in the applicability table unless explicitly specified otherwise .

This document cannot include every hardware solution or every product that can be designed. Where the suggested hardware configurations are not to be considered mandatory, the information provided should be used as a guide and starting point for the proper development of the product with the Telit module.

2.2 Audience

This document is intended for system integrators that are using the Telit ME310M1 module in their products.

2.3 Contact Information, Support

For technical support and general questions, e-mail:

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

Alternatively, use: https://www.telit.com/contact-us

Product information and technical documents are accessible 24/7 on our website: https://www.telit.com

2.4 Conventions

Note: Provide advice and suggestions that may be useful when integrating the module.

Danger: This information MUST be followed, or catastrophic equipment failure or personal injury may occur.

ESD Risk: Notifies the user to take proper grounding precautions before handling the product.

Warning: Alerts the user on important steps about the module integration.

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

2.5 Terms and conditions

Refer to https://www.telit.com/hardware-terms-conditions/.

2.6 Disclaimer

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3 General Product Description

3.1 Overview

The ME310M1 module is an LTE CAT-M1 and CAT-NB2 communication product that provides mIoT capabilities while mantaining an ultra-low power consumption. It is designed to support 3GPP Release 14-17 LPWA standards (LTE-M/NB-IoT (Cat-M1, Cat-NB1/NB2).

The ME310M1 operates with GPIOs voltage levels of 1.8V thus allowing for low power consumption and making it and ideal solution for battery-powered applications and wearable devices.

3.2 Product Variants and Frequency Bands

Table 2: Product Variants and their Frequency Bands

Product	2G Band (MHz)	LTE CATM1	NBIoT	CS Voice VoLTE	Region
ME310M1-W1	--	B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B71	B1, B2, B3, B4, B5, B8, B12, B13, B14, , B18, B19, B20, B25, B26, B28, , B66, , B71, B85	N	Worldwide
ME310M1-W2	--	B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B71	B1, B2, B3, B4, B5, B8, B12, B13, B14, , B18, B19, B20, B25, B26, B28, , B66, , B71, B85	N	Worldwide

Refer to the “RF Section” for details information about frequencies and bands.

> Note: Cellular technologies and frequency bands that are enabled may vary based on the firmware version and firmware configuration used.

3.3 Target Market

ME310M1 can be used for Global IoT applications such as smart metering, healthcare monitoring, home automation, industrial sensors, smart agriculture, asset tracking, point of sale, portable devices, and many more that benefit from low-power and low-data rate capabilities.

3.4 Main Features

Table 3: Functional Features

Function	Features
Modem	• NBIoT CAT-NB1 and CAT-NB2 technology • LTE CAT-M1 technology • SMS support (text and PDU) • Real-Time Clock
Interfaces	• USIF0 Main UART (AT command*) • USIF1 (AT command*) • AUX UART (FW Upgrade, Log) • SPI** • I2C • SIM • 6 GPIOs • Antenna ports (LTE and GNSS)

* Functionality depends on port configuration.

** Functionality will be available on future Maintenance releases

3.5 Mechanical Specifications

Dimensions

The overall dimensions of ME310M1-W1 and ME310M1-W2 are:

- Length: 18.0 mm
- Width: 15.0 mm
- Thickness: 2.6 mm

For detailed mechanical data, refer to section 8.1 Drawing.

Weight

The nominal weight of the ME310M1-W1 is 1.5 grams.

The nominal weight of the ME310M1-W2 is TBD grams.

3.6 Temperature Range

Table 4: Temperature Range

Description	Temperature Range	Note
Normal Operating Temperature Range	–40°C to TBD °C	The module is fully functional and compliant according to regulatory standards.
Extended Operating Temperature Range	-40°C to +90°C	The module is fully functional (*)
Storage Temperature Range	–40°C to +105°C	The module is not powered and not connected to the power supply

Note: (*) Funtional: If applicable, the module can make and receive data calls, send and receive SMS, and data traffic.

4 Pins Allocation

4.1 Pin-out

Table 5: Pin-out Information

Pin	Signal	I/O	Function	Type	Comment
Asynchronous Serial Port (USIF0) – Prog. / Data + HW Flow Control					
Y16	C103/TXD0	I	Serial data input (TXD) from DTE	CMOS 1.8V	Internal PU
AA15	C104/RXD0	O	Serial data output (RXD) to DTE	CMOS 1.8V	
Y18	C105/RTS0	I	Input for Request to send a signal (RTS) from DTE	CMOS 1.8V	Internal PU
AA17	C106/CTS0	O	Output for Clear to send a signal (CTS) to DTE	CMOS 1.8V	Internal PU
Asynchronous Serial Port (USIF1) – Prog. / Data + HW Flow Control					
Y12	TXD1	I	Serial data input (TXD) from DTE	CMOS 1.8V	Internal PU
AA11	RXD1	O	Serial data output (RXD) to DTE	CMOS 1.8V	
AA13	RTS1	I	Input for Request to send a signal (RTS) from DTE	CMOS 1.8V	Internal PU
Y14	CTS1	O	Output for Clear to send a signal (CTS) to DTE	CMOS 1.8V	Internal PU
Auxiliary Serial Port					
Y10	TX_AUX	O	Auxiliary UART (TX Data to DTE)	CMOS 1.8V	
AA9	RX_AUX	I	Auxiliary UART (RX Data to DTE)	CMOS 1.8V	Internal PU
SIM card interface					
L1	SIM_CLK	O	External SIM signal – Clock	CMOS 1.8V	
M2	SIM_RST	O	External SIM signal – Reset	CMOS 1.8V	
N1	SIM_DAT	I/O	External SIM signal – Data I/O	CMOS 1.8V	
P2	SIM_VCC	-	Power supply for the SIM	1.8V	Only 1.8V Simcard are supported
eSIM card interface (see Section xx)					
G4	M2M_SIM_CLK	I	Embedded SIM signal – Clock	CMOS 1.8V	

Pin	Signal	I/O	Function	Type	Comment
L4	M2M_SIM_RST	I	Embedded SIM signal – Reset	CMOS 1.8V	
J4	M2M_SIM_DAT	I/O	Embedded SIM signal – Data I/O	CMOS 1.8V	
K2	M2M_SIM_VCC	-	Power supply for the Embedded SIM	1.8V	Connect to SIM_VCC only
SPI					
AA5	SPI_MOSI	I/O	SPI MOSI	CMOS 1.8V	Internal PD
Y8	SPI_MISO	I/O	SPI MISO	CMOS 1.8V	Internal PD
AA7	SPI_CLK	I/O	SPI Clock	CMOS 1.8V	Internal PD
Y6	SPI_CS	I/O	SPI Chip Select	CMOS 1.8V	Internal PD
DVI					
F2	DVI_CLK	I/O	DVI Clock	CMOS 1.8V	
E1	DVI_TX	O	DVI TX	CMOS 1.8V	
D2	DVI_RX	I	DVI RX	CMOS 1.8V	
C1	DVI_WA0	I/O	DVI WA0	CMOS 1.8V	
I2C					
B8	I2C_CLK	I/O	I2C Clock	CMOS 1.8V	
R4	I2C_SDA	I/O	I2C Data	CMOS 1.8V	
Digital IO					
V11	IO1	I/O	Configurable GPIO01	CMOS 1.8V	
V13	IO2	I/O	Configurable GPIO02	CMOS 1.8V	
D7	IO3	I/O	Configurable GPIO03	CMOS 1.8V	
D9	IO4	I/O	Configurable GPIO04	CMOS 1.8V	
D11	IO5	I/O	Configurable GPIO05	CMOS 1.8V	
D13	IO6	I/O	Configurable GPIO06	CMOS 1.8V	

Pin	Signal	I/O	Function	Type	Comment
ADC and DAC					
B18	ADC	I	Analog To Digital Converter Input	A/D	
R16	DAC	O	Digital To Analog Converter Output	D/A	
RF Section					
A5	CELL_MAIN ANTENNA	I/O	Main Antenna (50 ohm)	RF	
E19	GNSS ANTENNA	I/O	GNSS Antenna (50 ohm)	RF	
Antenna Tuner (refer to the section 7.4 Antenna Tuner)					
G1	ATC1		Antenna Tuner Control	CMOS 1.8V	
J1	ATC2		Antenna Tuner Control	CMOS 1.8V	
H2	ATC3		Antenna Tuner Control	CMOS 1.8V	
V7	ATC4		Antenna Tuner Control	CMOS 1.8V	
GNSS Auxiliary Signals					
H18	GNSS_LNA_EN	O	GNSS Low Noise Amplifier Enable	CMOS 1.8V	
G16	GNSS_1PPS	O	1 Pulse Per Second synchronization	CMOS 1.8V	
Miscellaneous Functions					
B2	S_LED	O	Status LED	CMOS 1.8V	
N16	ON_OFF#/WAKE#	I	Input Command for Power ON/OFF and to wake from deep sleep mode	1.8V Tolerant	Active Low
P18	WAKE0		Wake-Up signal from DHx status	1.8V Tolerant	Internal PD (1Meg)
T2	WAKE1		Wake-Up signal from DHx status	1.8V Tolerant	Internal PD (1Meg)
R1	PWRMON	O	Power ON Monitor	Power	
R19	HW_SHUTDOWN#	I	HW Unconditional Shutdown	1.8V Tolerant	Active Low
Power Supply					
W1	VBATT_PA	-	Main power supply (Radio PA)	Power	
AA3	VBATT	-	Main power supply (Baseband)	Power	
GND					
A3	GND	-	Ground	Power	
A7	GND	-	Ground	Power	
A9	GND	-	Ground	Power	
A13	GND	-	Ground	Power	

Pin	Signal	I/O	Function	Type	Comment
A17	GND	-	Ground	Power	
B4	GND	-	Ground	Power	
B6	GND	-	Ground	Power	
B10	GND	-	Ground	Power	
B12	GND	-	Ground	Power	
B14	GND	-	Ground	Power	
B16	GND	-	Ground	Power	
C19	GND	-	Ground	Power	
D18	GND	-	Ground	Power	
F8	GND	-	Ground	Power	
F12	GND	-	Ground	Power	
F18	GND	-	Ground	Power	
G19	GND	-	Ground	Power	
H6	GND	-	Ground	Power	
H14	GND	-	Ground	Power	
J19	GND	-	Ground	Power	
K18	GND	-	Ground	Power	
M18	GND	-	Ground	Power	
N19	GND	-	Ground	Power	
P6	GND	-	Ground	Power	
P14	GND	-	Ground	Power	
T8	GND	-	Ground	Power	
T12	GND	-	Ground	Power	
U1	GND	-	Ground	Power	
V2	GND	-	Ground	Power	
W19	GND	-	Ground	Power	
Y2	GND	-	Ground	Power	
Y4	GND	-	Ground	Power	
RESERVED / RFU / NC					
A11	RESERVED	-	RESERVED		
A15	RESERVED	-	RESERVED		
J16	RESERVED	-	RESERVED		
L16	RESERVED	-	RESERVED		
L19	RESERVED	-	RESERVED		
N4	RESERVED	-	RESERVED		
T18	RESERVED	-	RESERVED		
U19	RESERVED	-	RESERVED		
V9	RESERVED	-	RESERVED		
V18	RESERVED	-	RESERVED		

Warning: Reserved pins must not be connected.

Warning: Preliminary Marketing Samples pinout might differ from table. Specifically, pin T2 is Reserved and pin P18 has Wake1 functionality instead of Wake0. If unsure please contact Technical Support.

4.2 LGA Pads Layout

Top View

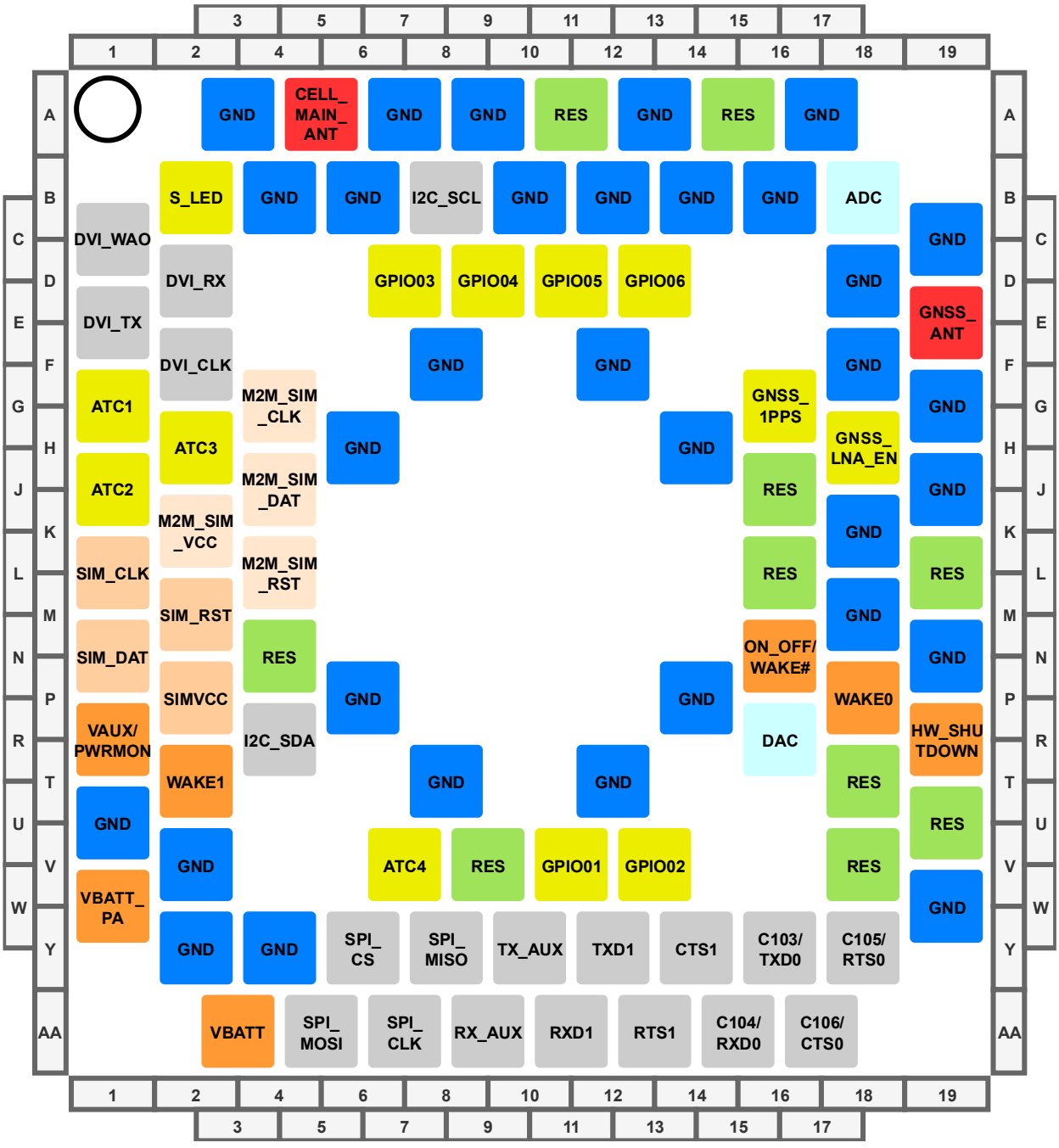


Figure 1: LGA Pads Layout

- SUPPLY AND CONTROL
- SIM CARD
- M2M eSIM
- ANALOG FUNCTIONALITY
- GROUND
- DIGITAL FUNCTIONALITY
- DIGITAL COMMUNICATION
- RF SIGNALS
- NO CONNECT / RESERVED FOR FUTURE USE

5 Power Supply

Board layout and power supply and distribution network are a very important part of the full product design and strongly impact on the performance of the module. Following requirements and guidelines should be taken into account to achieve a proper design.

5.1 Power Supply Requirements

The external power supply must be connected to VBATT and VBATT_PA pads and must fulfil the following requirements:

Table 6: Power Supply Requirements

Power Supply	Value
VBATT	
Nominal Supply Voltage	3.8V
Operating Voltage Range	2.5 V - 4.5 V
Extended Voltage Range	2.2 V - 4.5 V
VBATT_PA	
Nominal Supply Voltage	3.8V
Operating Voltage Range	2.5 V - 4.5 V
Extended Voltage Range	2.2 V - 4.5 V

Warning: The supply voltage of the modem must never exceed the Extended Operating Voltage Range. Improper implementation of the power supply guidelines described in this document can cause module failure.

Notes:

- For PTCRB approval on the final products the power supply is required to be within the regular “Operating Voltage Range”.
- The power supply section of the application must be carefully designed to avoid an excessive voltage drop during transmission peak current absorptions. If the voltage drops beyond the limits of the Extended Operating Voltage range, an unintentional module power-off can occur.
- When powering on the modem, the voltage must be within the “Extended Operating Voltage Range”.
- The Hardware Design Guide specifications shall be fully acknowledged and implemented correctly to use the module in its “Extended Operating Voltage Range”.

5.2 Power Consumption

ME310M1-W1 Idle Mode

Table 7: ME310M1-W1 Idle and PSM Mode

Mode	Measure (Typical)	Mode Description
IDLE mode	NBIoT (mA)	
AT+CFUN=1	TBD	Normal mode: full functionality of the module
AT+CFUN=4	TBD	Disabled TX and RX; the module is not registered on the network
AT+CFUN=5	TBD	Paging cycle #256 frames (2.56s DRx cycle)
	TBD	eDRX 81.92s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	TBD	EDRX w SIM SUSPEND 81.92 PTW 2.56 PAGING: 1.28(uA) AVG
	TBD	327.68s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	TBD	655.36s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	TBD	1310.72s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	TBD	2621.44s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	-	Paging Multiframe 9
PSM mode	Typical (mA)	
AT+CPSMS=1	TBD	No current source or sink by any connected pin

ME310M1-W2 Idle Mode

Table 8: ME310M1-W2 Idle and PSM Mode

Mode	Measure (Typical)	Mode Description
IDLE mode	NBIoT(mA)	
AT+CFUN=1	TBD	Normal mode: full functionality of the module
AT+CFUN=4	TBD	Disabled TX and RX; the module is not registered on the network
AT+CFUN=5	TBD	Paging cycle #256 frames (2.56s DRx cycle)
	TBD	eDRX 81.92s eDRx cycle length (PTW=2.56s, DRX=1.28s) AVG
	TBD	EDRX SUSPEND 81.92 PTW 2.56 PAGING: 1.28(uA)
	TBD	327.68s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	TBD	655.36s eDRx cycle length (PTW=2.56s, DRX=1.28s)

Mode	Measure (Typical)	Mode Description
	TBD	1310.72s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	TBD	2621.44s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	-	Paging Multiframe 9
PSM mode	Typical (mA)	
AT+CPSMS=1	TBD	No current source or sink by any connected pin

Note: The reported LTE CAT NB1 idle mode values are average among all the product variants and bands for each network wireless technology.

The support for a specific network wireless technology depends on the product variant configuration.

ME310M1-W1 Connected Mode

Table 9: ME310M1-W1 Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
NBIoT	TBD	TBD	3.75KHz, 1 SC MCS-0 BPSK, 23dBm (bands 12, 28, 85)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 12, 28, 85)
	TBD	TBD	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 5,8,13,20)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 5,8,13,20)
	TBD	TBD	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 1,2,3,4,25,66)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21 dBm (bands 1,2,3,4,25,66)

ME310M1-W2 Connected Mode

Table 10: ME310M1-W2 Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
NBIoT	TBD	TBD	3.75KHz, 1 SC MCS-0 BPSK, 23dBm (bands 12, 28, 85)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 12, 28, 85)
	TBD	TBD	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 5,8,13,20)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 5,8,13,20)
	TBD	TBD	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 1,2,3,4,25,66)
	TBD	TBD	15kHz, 12 SC MCS-5 QPSK, 21 dBm (bands 1,2,3,4,25,66)

5.3 General Design Rule

The main guidelines for the Power Supply Design include three different design steps:

- The electrical design of the power supply
- The thermal design
- The PCB layout

Electrical Design Guidelines

TBD

Thermal Design Guidelines

The worst case as reference values for the thermal design of ME310M1 are:

- Average current consumption (LTE CAT M1 and NB1 modes): TBD mA
- Supply voltage: 4.50V

Note: Ensure a proper connection from module LGA GND pads to a large surfaces of copper on host PCB.

Note: The ME310M1 includes a function to prevent overheating.

Power Supply PCB Layout Guidelines

- Values listed in the Electrical Design Guidelines section refer to voltage level and ripple admissible at the LGA input pads of the module. Application designer must ensure to fulfill those requirements for all working conditions. In order to meet specifications defined in this document the user must ensure that the Power Distribution Network (PDN from now on) has minimal impedance between the PoL converter on the host board and the power pins of the module, this way the voltage drop due to the communication related current consumption peaks will be minimized. In designs where the PoL converter(s) are not located close to the module it is strongly advised to adhere the following guidelines: Place a low ESR capacitor close to the Telit ME310M1 power input pads , a combination of 2 MLCC capacitors of values 47uF and 470nF is shown to provide adequate bypass capabilities for most applications.
- The PCB's traces from the PoL converter to the bypass capacitors must be wide enough to ensure that no significant voltage drop occur.
- The placement of the PDN on the board should be done in such a way as to guarantee that the high current return paths on the ground plane are not overlapping any noise-sensitive circuitry such as the microphone amplifier/buffer or earphone amplifier.
- The power supply input cables should be kept separate from noise-sensitive lines such as microphone/earphone cables.
- The insertion of the EMI filter(s) on the VBATT pins is recommended in those designs where the antenna is placed close to the battery or power supply lines. For this purpose, a ferrite bead-like Murata BLM18EG101TN1, Taiyo Yuden P/N FBMH1608HM101 or equivalent can be used.

5.4 RTC Supply

RTC is operational when ME310M1 is in PSM or OFF state and VBATT pin is supplied.

RTC settings are lost when the VBATT supply is removed.

5.5 PWRMON Power-on Monitor

PWRMON is always active (output high) when the module is powered ON (module powered ON indication) and cannot be set to a LOW level by any AT command.

This signal is present on pin R1. The operating range characteristics of the PWRMON signal are:

Table 11: Operating Range Characteristics of PWRMON signal

Item	Min	Typical	Max
Output voltage	1.7V	1.8V	1.8V
Output current	-	10mA	30mA

Note: PWRMON during the PSM period is LOW (PSM must be previously enabled by AT+CPSMS command).

Note: The Output Current MUST never be exceeded; care must be taken when designing the application section to avoid excessive current consumption. If the Current exceeds the limits it may cause a module shutdown.

Warning: This signal can be used to supply small devices (ie. Signal voltege level translators) from the module if the power budget defined in the previous table is not violated.

6 Digital Section

ME310M1 has four main operation states:

- **OFF state:** Vbatt is applied and only RTC is running. Baseband is switched OFF and the only change possible is the ON state.
- **ON state:** baseband is fully switched on and ME310M1 is ready to accept AT commands. ME310M1 can be idle or connected.
- **Sleep mode state:** main baseband processor is intermittently switched ON and AT commands can be processed with some latency. ME310M1 is idle with low current consumption.
- **Deep sleep mode state:** PSM defined in 3GPP Release 12. Baseband is switched OFF most of the time.

6.1 Logic Levels

Table 12: Logic Levels Minimum and Maximum

Parameter	Min	Max
Absolute Maximum Ratings – Not Functional		
Input level on any digital pin (CMOS 1.8) to ground	-0.3V	2.1V
Operating Range - Interface levels (1.8V CMOS)		
Input high level	TBD	TBD
Input low level	TBD	TBD
Output high level	TBD	TBD
Output low level	TBD	TBD

Table 13: Logic Levels Average

Parameter	AVG
Current Characteristics	
Output Current	TBD mA
Input Current	TBD uA

6.2 Power On

The module is AUTO ON with VBATT.

The following flow chart shows the proper “Modem Turn ON” procedure.

ON_OFF#/WAKE# must be tied low for at least TBD seconds before before being released, in a future sofwtare development

> Note: Do not use any pull-up resistor on the ON_OFF#/WAKE# line, it is internally pulled up. Using a pull-up resistor may bring latch-up problems on the ME310M1 power regulator and improper power on/off of the module. The ON_OFF#/WAKE# line must be connected only in an open collector or open drain configuration.
>
> In this document, all the inverted lines, so they have active low signals are labelled with a name ending with”#","*”, or with a bar over the name.
>
> To check if the device has powered on, the hardware line PWRMON should be monitored.

6.3 Power Off

The proper procedure to power-off the module is to use the AT#SHDN command (will be available in a future software release).

An alternative HW procedure is to use the ON_OFF#/WAKE# pin which is described in the following flow chart that represents the power-off procedure. ON_OFF#/WAKE# pin must be tied low for at least TBD seconds to power-off the module which sends a disconnection request to the network informing that the device will no longer be reachable.

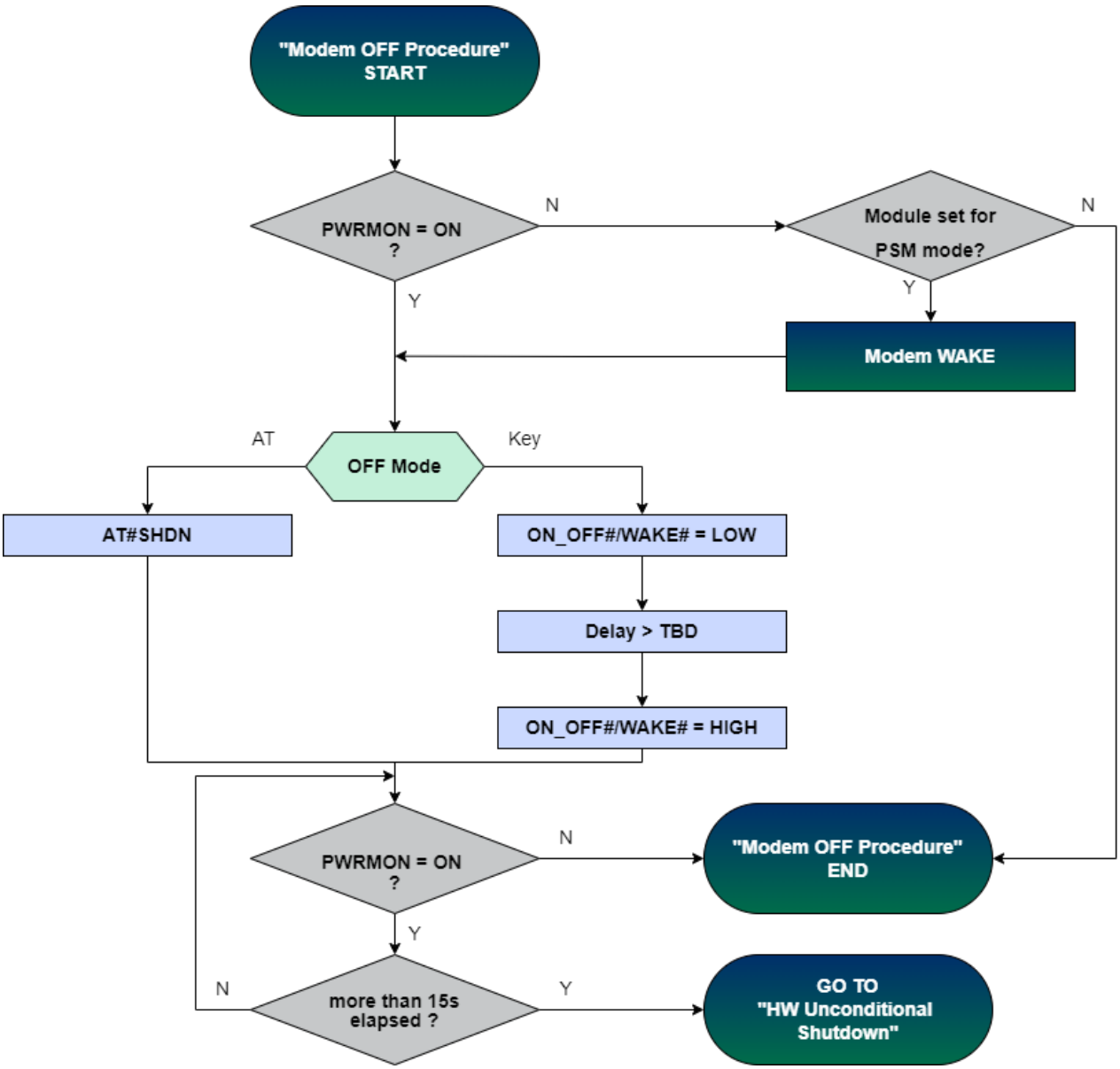


Figure 2: Power Off Procedure Flow Chart

6.4 Wake up From Deep Sleep Mode

The ME310M1 module supports Power Saving Mode (PSM) functionality defined in 3GPP release 12. When the Periodic Update Timer expires, the module shuts down until the next scheduled wake-up. Asynchronous events controlled by the host may wake up the module from deep sleep mode, this functionality is achieved by asserting

ON_OFF#/WAKE# pin LOW for at least TBD milliseconds but no more than TBD seconds like in 6.2. Power On section or by driving the WAKE0 pin high to 1.8V.

The host can detect deep sleep mode by polling the PWRMON pin if PSM has been previously configured.

6.5 Unconditional Shutdown

The following flow chart shows the proper procedure for an unconditional shutdown of the Telit ME310M1 module. When the procedure is complete the module is reset and it stops all operations. The module will not perform any disconnection procedure from the network and will power down regardless of its operational status.

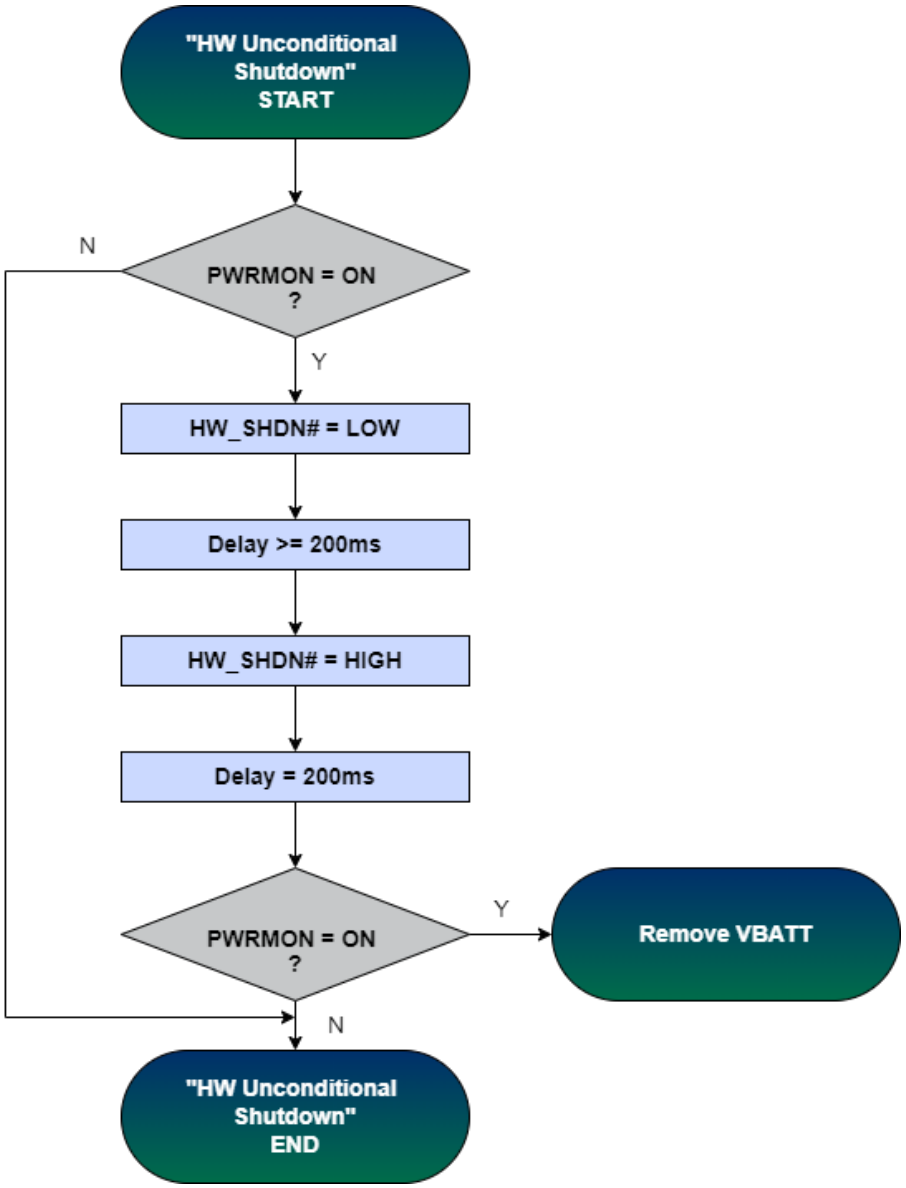


Figure 3: Unconditional Shutdown Procedure Flow Chart

Warning: Unconditional Hardware SHUTDOWN by toggling VBATT Power, must not be used during the normal shutdown operation of the device. It does not detach the device from the network and may damage the memory content. It must be performed only as an emergency exit procedure.

INCORRECT SHUTDOWN Procedure may void the warranty.

6.6 Communication Ports

SPI

The ME310M1 module is provided by a standard 3-wire SPI master or slave interface with chip select control. The following table lists the available signals:

Table 14: SPI Available Signals

PAD	Signal	I/O	Function	Type	NOTE
AA5	SPI_MOSI	I/O	SPI MOSI	CMOS 1.8V	Internal PD
Y8	SPI_MISO	I/O	SPI MISO	CMOS 1.8V	Internal PD
AA7	SPI_CLK	I/O	SPI Clock	CMOS 1.8V	Internal PD
Y6	SPI_CS	I/O	SPI Chip Select	CMOS 1.8V	Internal PD

Note: The SPI interface is in the roadmap for future SW releases.

Serial Ports

The ME310M1 module provides 3 Asynchronous serial ports:

- Asynchronous Serial Port (USIF0)
- Asynchronous Serial Port (USIF1)
- Auxiliary Serial Port

Several configurations can be implemented on OEM hardware, but the most common are:

- RS232 PC COM port
- Microcontroller UART @ 1.8V (Universal Asynchronous Receive Transmit)
- Microcontroller UART @ 5V or other voltages different from 1.8V.

Depending on the serial port voltage levels on the OEM hardware, a level translator circuit may be needed. The ME310M1 digital interfaces are LVCMOS 1.8V unless explicitly stated otherwise in the 4.1 Pin-out section.

Asynchronous Serial Port (USIF0)

The serial port 0 on the ME310M1 is a +1.8V UART with 4 RS232 signals. It differs from the PC-RS232 because of signal polarity (RS232 is reversed) and voltage levels.

The following table lists the available signals:

Table 15: Asynchronous Serial Port (USIF0) Available Signals

RS232 Pin	Signal	PAD	Name	Usage
2	C104/ RXD0	AA15	Transmit line	Output transmit line of ME310M1 UART
3	C103/ TXD0	Y16	Receive line	Input receiver of the ME310M1 UART Internal Pull-up
4	DTR		Data Terminal Ready	N.A.
8	C106/CTS0	AA17	Clear to Send	Output from the ME310M1 that controls the Hardware flow control
7	C105/RTS0	Y18	Request to Send	Input to the ME310M1 that controls the Hardware flow control Internal Pull-up
9	RING		Ring Indicator	N.A.

Note: According to V.24, some signal names are referred to the application side, therefore on the ME310M1 side these signals are in the opposite direction:

- TXD on the application side will be connected to the receiving line (here named C103/TXD0)
- RXD on the application side will be connected to the transmit line (here named C104/RXD0)
- For applications where the flow control is not needed or the host does not provide a full UART interface, only the TXD and RXD lines can be connected, the other lines can be left open. For these use cases it is suggested to enable the software flow control.
- To avoid back powering, it is required not to drive any signal to logic level High if VBATT is not supplied to the module, the module is in off state or in any of the low power modes or during an ON/OFF transition (RESET included). The PRWMON signal can be used to identify such states, no digital inout signal should be actively driven to logic high when PWRMON signal is Low, for pull-up resistors connected to host supply rails the user shall ensure that the total input current flowing into the ME310M1 module is less than 2mA .

Asynchronous Serial Port (USIF1)

The serial port 1 on the ME310M1 is a +1.8V UART with 4 RS232 signals. It differs from the PC-RS232 because of signal polarity (RS232 is reversed) and voltage levels.

The following table lists the available signals:

Table 16: Asynchronous Serial Port (USIF1) Available Signals

RS232 Pin	Signal	PAD	Name	Usage
2	RXD1	AA11	Transmit line	Output transmit line of ME310M1 UART
3	TXD1	Y12	Receive line	Input receiver of the ME310M1 UART Internal Pull-up
4	DTR		Data Terminal Ready	N.A.
8	CTS1	Y14	Clear to Send	Output from the ME310M1 that controls the Hardware flow control
7	RTS1	AA13	Request to Send	Input to the ME310M1 that controls the Hardware flow control Internal Pull-up
9	RING		Ring Indicator	N.A.

Note: According to V.24, some signal names are referred to the application side, therefore on the ME310M1 side these signals are in the opposite direction:

- TXD on the application side will be connected to the receiving line (here named TXD1)
- RXD on the application side will be connected to the transmit line (here named RXD1)
- For applications where the flow control is not needed or the host does not provide a full UART interface, only the TXD and RXD lines can be connected, the other lines can be left open. For these use cases it is suggested to enable the software flow control.
- To avoid back powering, it is required not to drive any signal to logic level High if VBATT is not supplied to the module, the module is in off state or in any of the low power modes or during an ON/OFF transition (RESET included). The PRWMON signal can be used to identify such states, no digital inout signal should be actively driven to logic high when PWRMON signal is Low, for pull-up resistors connected to host supply rails the user shall ensure that the total input current flowing into the ME310M1 module is less than 2mA .

Auxiliary Serial Port

The auxiliary serial port on the ME310M1 is a LVCMOS 1.8V interface comprising only the RX and TX signals. The signals of the ME310M1 serial port are:

Table 17: ME310M1 Serial Port Signals

RS232 Pin	Signal	Pad	Name	Usage	Note
Y10	TX_AUX	O	Auxiliary UART (TX Data to DTE)	CMOS 1.8V	
AA9	RX_AUX	I	Auxiliary UART (RX Data from DTE)	CMOS 1.8V	Internal Pull-up

> Warning: Auxiliary Serial Port cannot be used to send AT commands to the module. This interface is used to perform firmware updates and collect logs/trace.

6.7 General Purpose I/O

The ME310M1 module is equipped with a set of Configurable Digital Input / Output pins (LVCMOS 1.8V). The Input pads can only be read; they report the digital value (high or low) present on the pad at the read time. The Output pads can be written or queried to set and confirm the value of the output driver.

For GPIOs providing more than one predefined functionality, the alternate function pin is internally controlled by the ME310M1 firmware and its behavior depends on the implemented function.

The following table shows the available GPIO on the ME310M1:

Table 18: ME310M1 Available GPIO

PAD	Signal	I/O	Drive Strength	Default State	NOTE
V11	GPIO_01	I/O	1 mA	TBD	
V13	GPIO_02	I/O	1 mA	TBD	
D7	GPIO_03	I/O	1 mA	TBD	
D9	GPIO_04	I/O	1 mA	TBD	
D11	GPIO_05	I/O	1 mA	TBD	
D13	GPIO_06	I/O	1 mA	TBD	

Using a GPIO as an INPUT

GPIO pads, when used as inputs, can be connected to another device's digital output and report its status, provided that this device has interface levels compatible with the 1.8V LVCMOS levels of the GPIO.

> Note: To avoid a back powering, it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the ME310M1 when the module is powered off or during an ON/OFF transition.

Using a GPIO as an OUTPUT

The GPIO pads, when used as outputs, can drive 1.8V LVCMOS or level compatible digital devices or compatible hardware. When set as outputs, the pads have a push-pull output and therefore the pull-up resistor may be omitted.

6.8 ADC Converter

The ME310M1 is equipped with a single AD converter input accessible through the ADC line, which is located on Pad B18. The allowed input voltage range for this pin is 0V to 1.8V. Additionally, the resolution of the converter is adjustable within the range of 6 to 12 bits.

The following table is showing the ADC characteristics:

Table 19: ADC Characteristics

Item	Min	Typical	Max	Unit
Input Voltage range	0	-	1.8	Volt
AD conversion	6	-	12	bits

Using ADC Converter

Available in the next document revision.

6.9 DAC Converter

The ME310M1 provides a Digital to Analog Converter output pin. The output signal (named DAC) is available on pin **R16** of the ME310M1.

Enabling DAC

Available in the next document revision.

6.10 SIM Card Interface

The ME310M1 provides one UIM card interface.

Table 20: ME310M1 SIM Card Interface

PAD	Signal	I/O	Drive Strength	Drive Strength	Reset status
L1	SIM_CLK	O	External SIM signal – Clock	TDB mA	
M2	SIM_RST	O	External SIM signal – Reset	TDB mA	
N1	SIM_DAT	I/O	External SIM signal – Data I/O	TDB mA	
P2	SIM_VCC	-	Power supply for the SIM	TDB mA	
	SIM_CD	I	External SIM - Card Detect	N/A	

The SIM Interface supports only 1.8V compliant UIM cards.

The SIM Card interface signal can either be used to connect to an host-provided SIM Card or Card holder. Alternatively, for modules providing this functionality, the signals can be routed to the eSIM Card Interface.

6.11 eSIM Card Interface

For selected ME310M1 modules that provide an embedded UIM, a dedicated eSIM Card Interface is exported.

Table 21: ME310M1 eSIM interface

PAD	Signal	I/O	Drive Strength	Drive Strength	Reset status
G4	M2M_SIM_CLK	O	Embedded SIM signal – Clock	TDB mA	
L4	M2M_SIM_RST	O	Embedded SIM signal – Reset	TDB mA	
J4	M2M_SIM_DAT	I/O	Embedded SIM signal – Data I/O	TDB mA	
K2	M2M_SIM_VCC	-	Power supply for the Embedded SIM	TDB mA	

To leverage the functionality of the embedded SIM, the host board shall route the SIM Card Interface signals to the omologous signal of the eSIM Card Interface. Specifically, the mapping of connections between the SIM and eSIM interfaces are:

- L1 <-> G4
- M2 <-> L4
- N1 <-> J4
- P2 <-> K2

Following image defines an Host board connection example for the SIM and eSIM interfaces:

TBD

6.12 Emergency Recovery Procedure

It is strongly advised for the end user design to include a set of test points on RX_AUX and TX_AUX (AA9 and Y10 respectively). This will allow for an emergency recovery procedure if any standard firmware upgrade operation is no longer possible. It is also recommended, although not mandatory for emergency recovery, that the design includes test points, or makes them available in any other way, on GPIO 5 and 6 of the module.

In the event of a failure that will require performing this procedure, the client is required to contact a FAE for detailed instructions about the procedure.

7 RF Section

7.1 TX Output Power

ME310M1-W1 and ME310M1-W2

Table 22: ME310M1-W1 and ME310M1-W2 TX Output Power

Band	Mode	Class	RF power (dBm) Nominal*
B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B28, B66, B71, B85	(LTE) CAT-NB1		TBD
B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B28, B66, B71, B85	(LTE) CAT-NB2		TBD
B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B71	(LTE) CAT-M1		TBD

* Max output power tolerance range according to 3GPP TS 36.521-1 or better

7.2 RX Sensitivity

ME310M1-W1 and ME310M1-W2

Table 23: ME310M1-W1 and ME310M1-W2 RX Sensitivity

Mode / Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band1	TBD	-108.2
CAT NB2 / Band2	TBD	-108.2
CAT NB2 / Band3	TBD	-108.2
CAT NB2 / Band4	TBD	-108.2
CAT NB2 / Band5	TBD	-108.2
CAT NB2 / Band8	TBD	-108.2
CAT NB2 / Band12	TBD	-108.2
CAT NB2 / Band13	TBD	-108.2
CAT NB2 / Band14	TBD	
CAT NB2 / Band18	TBD	-108.2
CAT NB2 / Band19	TBD	-108.2
CAT NB2 / Band20	TBD	-108.2
CAT NB2 / Band25	TBD	-108.2
CAT NB2 / Band26	TBD	-108.2
CAT NB2 / Band28	TBD	-108.2
CAT NB2 / Band66	TBD	-108.2
CAT NB2 / Band71	TBD	
CAT NB2 / Band85	TBD	-108.2

* 3GPP TS 36.521-1 Release 15 Minimum performance requirement)

Table 24: RX Sensitivity ME310M1-W1 & W2

Mode / Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT M1 / Band1	TBD	-102.7
CAT NB2 / Band2	TBD	-100.3
CAT NB2 / Band3	TBD	-99.3
CAT NB2 / Band4	TBD	-102.3
CAT NB2 / Band5	TBD	-100.8
CAT NB2 / Band8	TBD	-99.8
CAT NB2 / Band12	TBD	-99.3
CAT NB2 / Band13	TBD	-99.3
CAT NB2 / Band14	TBD	None
CAT NB2 / Band18	TBD	-102.3
CAT NB2 / Band19	TBD	-102.3
CAT NB2 / Band20	TBD	-99.8
CAT NB2 / Band25	TBD	None
CAT NB2 / Band26	TBD	-100.3
CAT M1 / Band27	TBD	-100.8

Mode / Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band28	TBD	-100.8
CAT NB2 / Band66	TBD	None
CAT NB2 / Band71	TBD	None
CAT NB2 / Band85	TBD	None

* 3GPP TS 36.521-1 Release 15 Minimum performance requirement

7.3 Antenna Requirements

The antenna connection and board layout design are the most important aspects of the overall product design as they strongly affect the general performance of the product. Therefore, it is essential to carefully read and adhere to the requirements and guidelines for a proper design.

The antenna and antenna transmission line on the PCB for a Telit ME310M1 device must fulfil the following requirements:

Table 25: ME310M1 Antenna and Antenna Transmission Line on PCB

Item	Value
Frequency range	Depending on the frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
Bandwidth	TBD
Impedance	50 ohm
Input power	ME310M1-W1: ME310M1-W2:
VSWR absolute max	TBD
VSWR recommended	TBD

PCB Design Guidelines

When using the ME310M1, since there's no antenna connector on the module, the antenna must be connected to the ME310M1 antenna pad using a transmission line implemented on the PCB.

This transmission line shall fulfil the following requirements:

Table 26: ME310M1 Antenna Pad Requirements

Item	Value
Characteristic Impedance	50 ohm (+-10%)
Max Attenuation	0.3 dB
Coupling	Coupling with other signals shall be avoided
Ground Plane	The cold End (Ground Plane) of the antenna shall be equipotential to the ME310M1 ground pins

The transmission line should be designed according to the following guidelines:

- Make sure that the transmission line characteristic impedance is 50ohm;
- Keep line on the PCB as short as possible. The antenna line losses shall be less than about 0.3 dB;
- Line geometry should have uniform characteristics with constant cross-section. Avoid meanders and changes in the geometry of the transmission line;
- Any kind of suitable geometry/structure (microstrip, stripline, coplanar, grounded coplanar waveguide...) is allowed to connect the module to the antenna;
- If the transmission line requires a GND reference plane, ensure that this plane has no slots or cuts that might affect the return current path hence altering the expected impedance. Proper design guidelines for high-speed RF designs should be followed;
- If possible, use one layer of the PCB as the reference ground plane and refer the transmission line to this plane;
- It is advisable although not strictly necessary, to provide a GND plane also on the sides of the antenna transmission line (separation >3W where W is the trace width) with proper via stitching to the reference GND plane underneath;
- Avoid routing any digital signal or noisy power supply directly below the antenna signals;
- Place the noisy EM devices as far as possible from the ME310M1 antenna line;
- Keep the antenna line far away from the ME310M1 power supply lines;
- If EM noisy devices (such as fast switching ICs, LCD, and so on) are present on the PCB hosting the ME310M1, take care of the shielding of the antenna line by burying it in an inner layer of PCB and surrounding it with the ground planes, or shield it with a metal frame cover;
- If the noisy EM devices are not present around the line the use of geometries such as microstrip or grounded coplanar waveguide is preferable since they typically ensure less attenuation than a Stripline of the same length.

7.4 Antenna Tuner

TBD

8 Mechanical Design

8.1 Drawing

ME310M1-W1 and ME310M1-W2

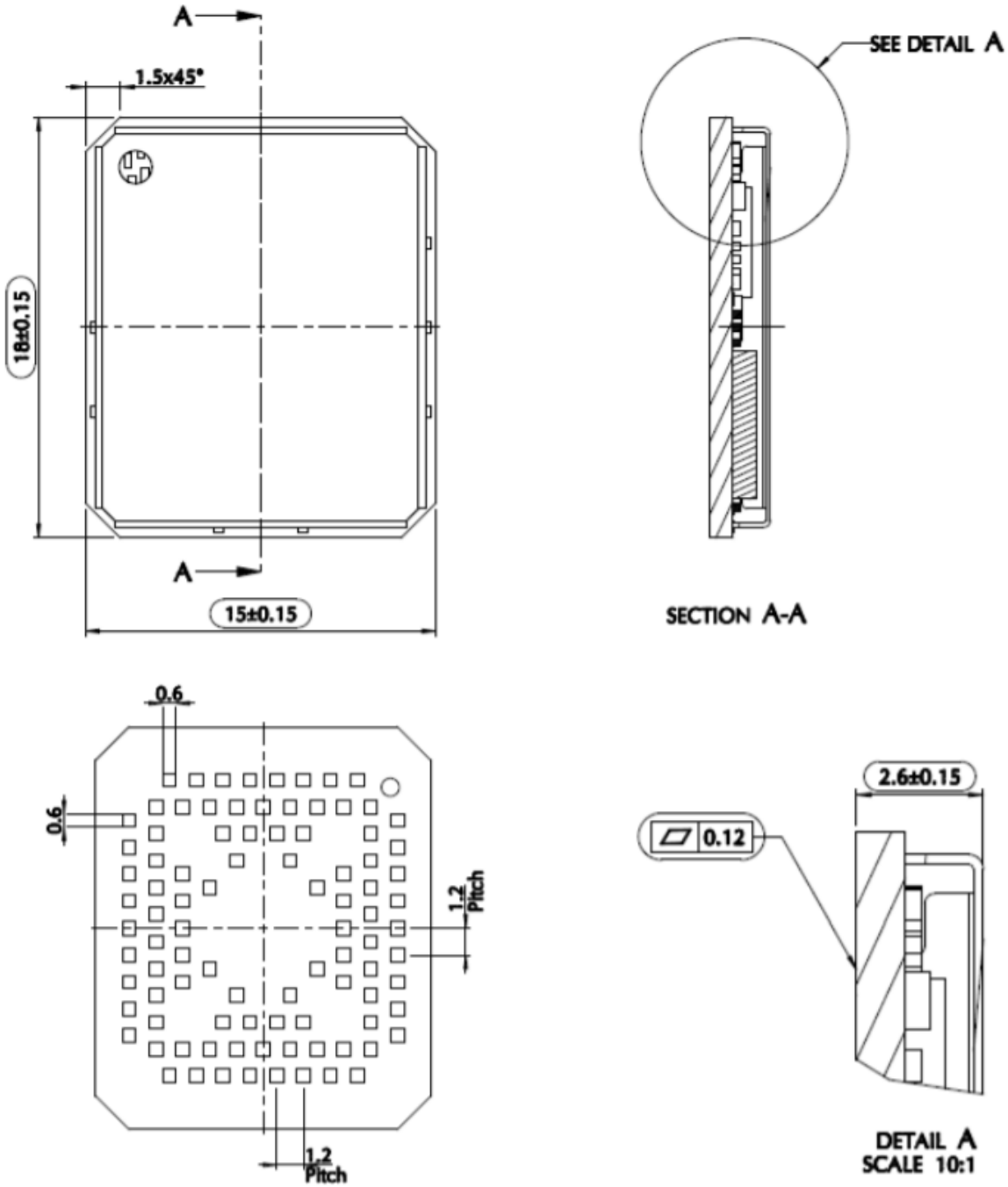


Figure 4: Mechanical Drawing ME310M1-W1 and ME310M1-W2

Note: Dimensions in mm. General Tolerance ±0.1, Angular Tolerance ±1°, The tolerance is not cumulative.

9 Application PCB Design

The ME310M1 modules have been designed to be compliant with a standard lead-free SMT process.

9.1 Recommended Footprint for the Application

ME310M1-W1 and MW310M1-W2

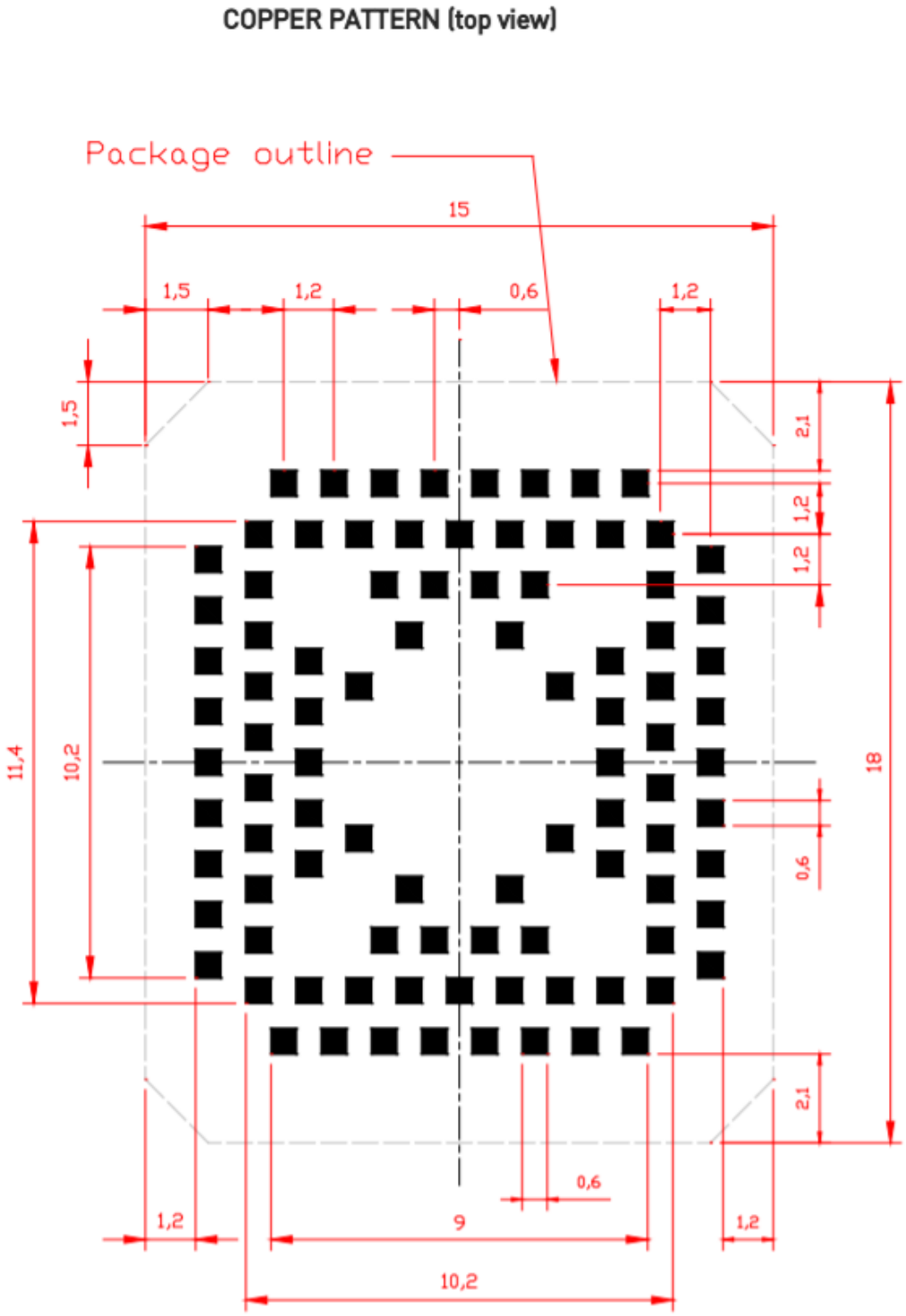


Figure 5: ME310M1-W1 and ME310M1-W2 Copper Pattern (top view)

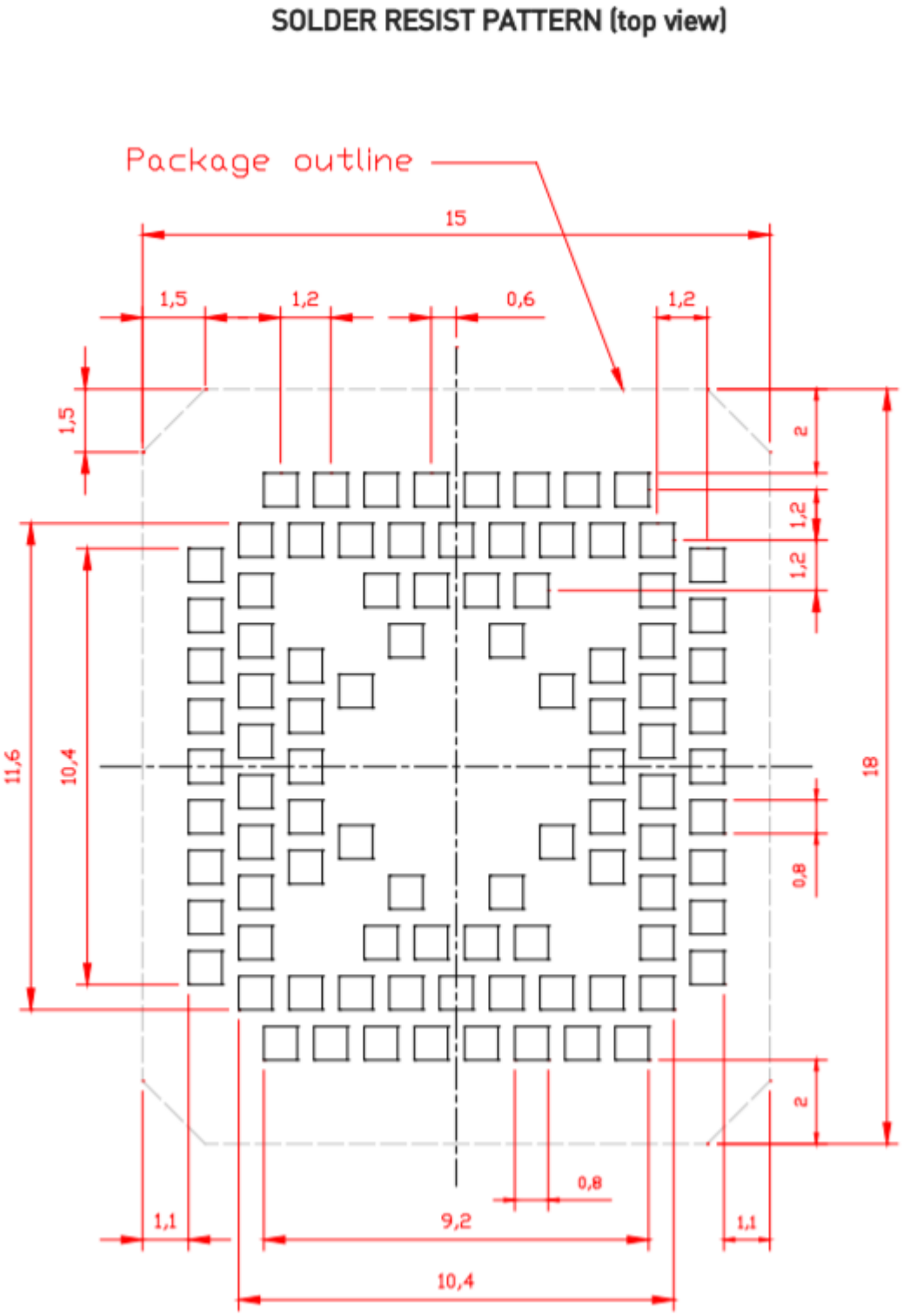
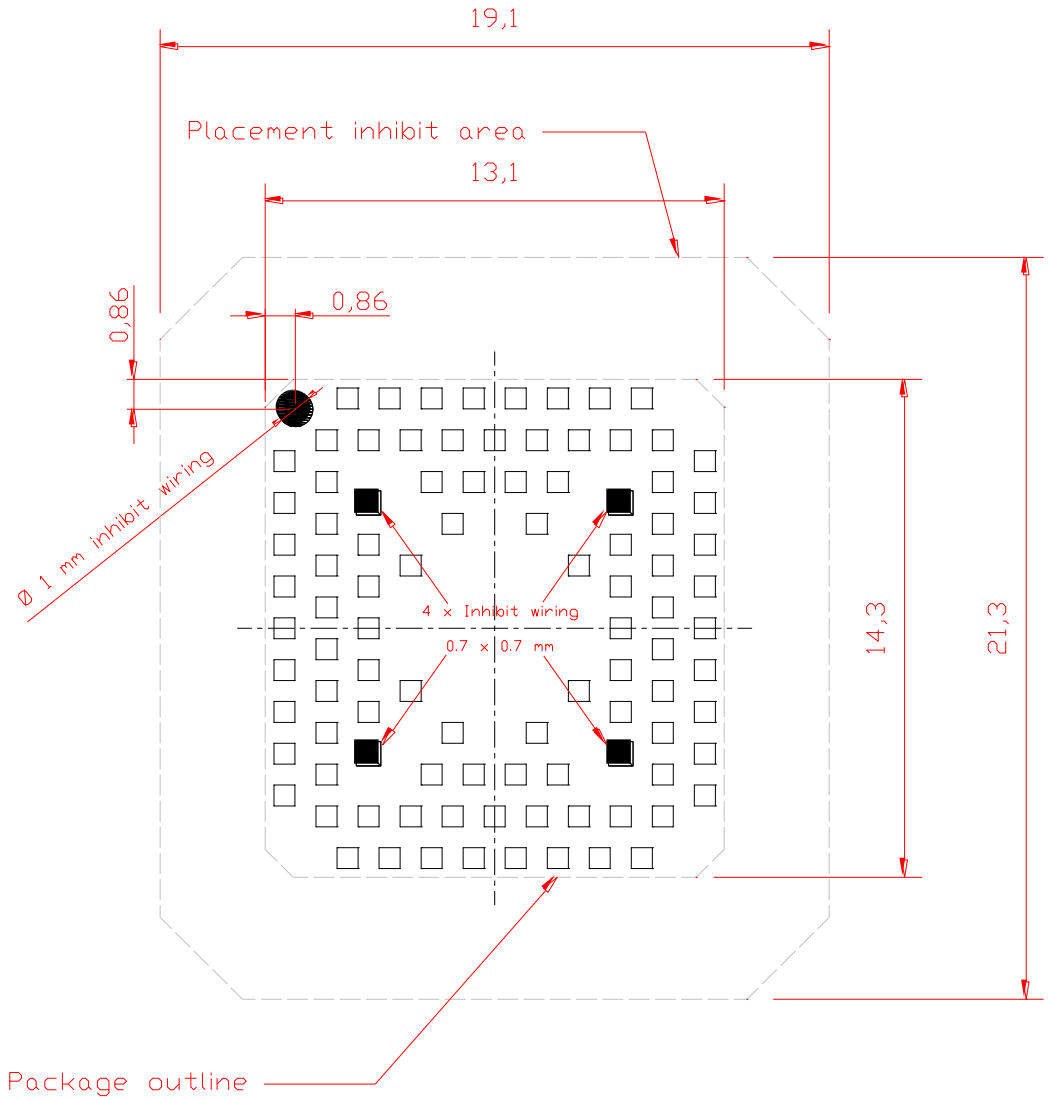


Figure 6: ME310M1-W1 and ME310M1-W2 Solder resist pattern (top view)

9.2 Recommendations for ME310M1-W1 and ME310M1-W2

To easily rework the ME310M1-W1 and ME310M1-W2, it is recommended to consider on the application a 2 mm placement inhibit area around the module.

It is also suggested, as a common rule for an SMT component, to avoid a mechanical part of the application being in direct contact with the module.



Note: In the customer application, the region under WIRING INHIBIT (see figure above) must be clear from signal or ground paths.

9.3 PCB Pad Design

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

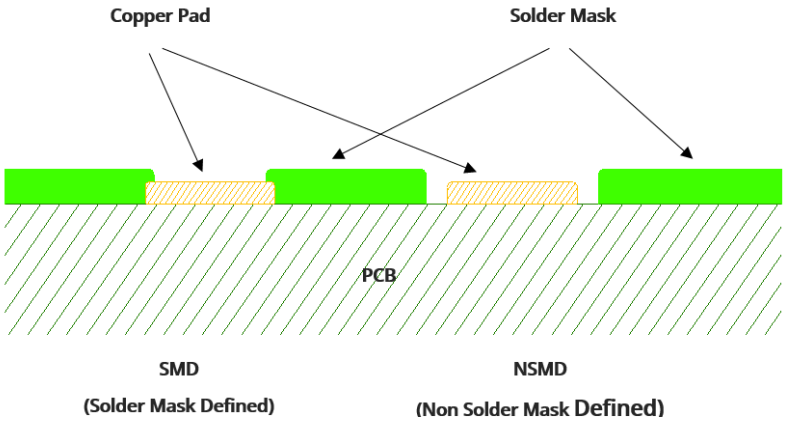


Figure 7: PCB Solder Pad Recommendations

9.4 Recommendations for PCB Pad Dimensions

The recommendation for the PCB pad dimensions is 1:1 with module pads.

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 as the pad itself.

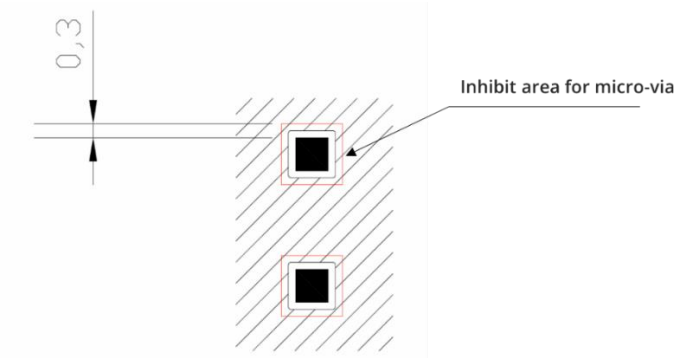


Figure 8: Pad Dimensions Recommendations

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

Recommendations for PCB pad surfaces:

Table 27: Recommendations for PCB pad surfaces

Finish	Layer Thickness(um)	Properties
Electro-less Ni / Immersion Au	3 –7 / 0.03 – 0.15	good solder ability protection, high shear force values

The PCB must be able to resist the higher temperatures which are occurring during the lead-free process. This issue should be discussed with the PCB supplier. In general, the wettability of tin-lead solder paste on the described surface plating is better than the lead-free solder paste.

It is not necessary to panel the application's PCB, however in that case it is recommended to use milled contours and perforated breakaway tabs; scoring or v-cut solutions are not recommended.

9.5 Stencil

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

9.6 Solder Paste

Table 28: Solder Paste

Item	Lead-Free
Solder Paste	Sn/Ag/Cu

We recommend using only "no clean" solder paste to avoid the cleaning of the modules after assembly.

9.7 Solder Reflow

Recommended solder reflow profile:

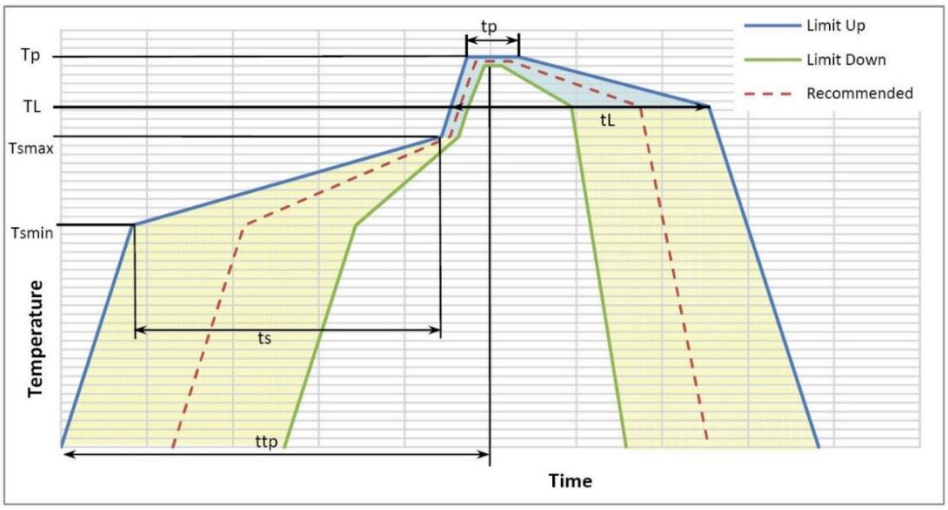


Figure 9: Recommended Solder Reflow Profile

Warning: The aforementioned 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 based on the overall system considering factors such as thermal mass and warpage.

Table 29: Profile Feature Recommendations

Profile Feature	Pb-Free Assembly Free
Average ramp-up rate (T_L to T_P)	3°C/second max
Preheat • Temperature Min (Tsmin) • Temperature Max (Tsmax) • Time (min to max) (ts)	 150°C 200°C 60-180 seconds
Tsmax to TL • Ramp-up Rate	 3°C/second max
Time maintained above: • Temperature (TL) • Time (tL)	 217°C 60-150 seconds
Peak Temperature (Tp)	245 +0/-5°C
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

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

Warning: THE ME310M1 MODULES WITHSTANDS ONE REFLOW PROCESS ONLY. please make sure that in a double-side assembly process the module side will be the latter to be soldered.

Warning: The aforementioned 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 factors such as thermal mass and warpage.

10 Packaging

10.1 Tray

ME310M1-W1 and ME310M1-W2

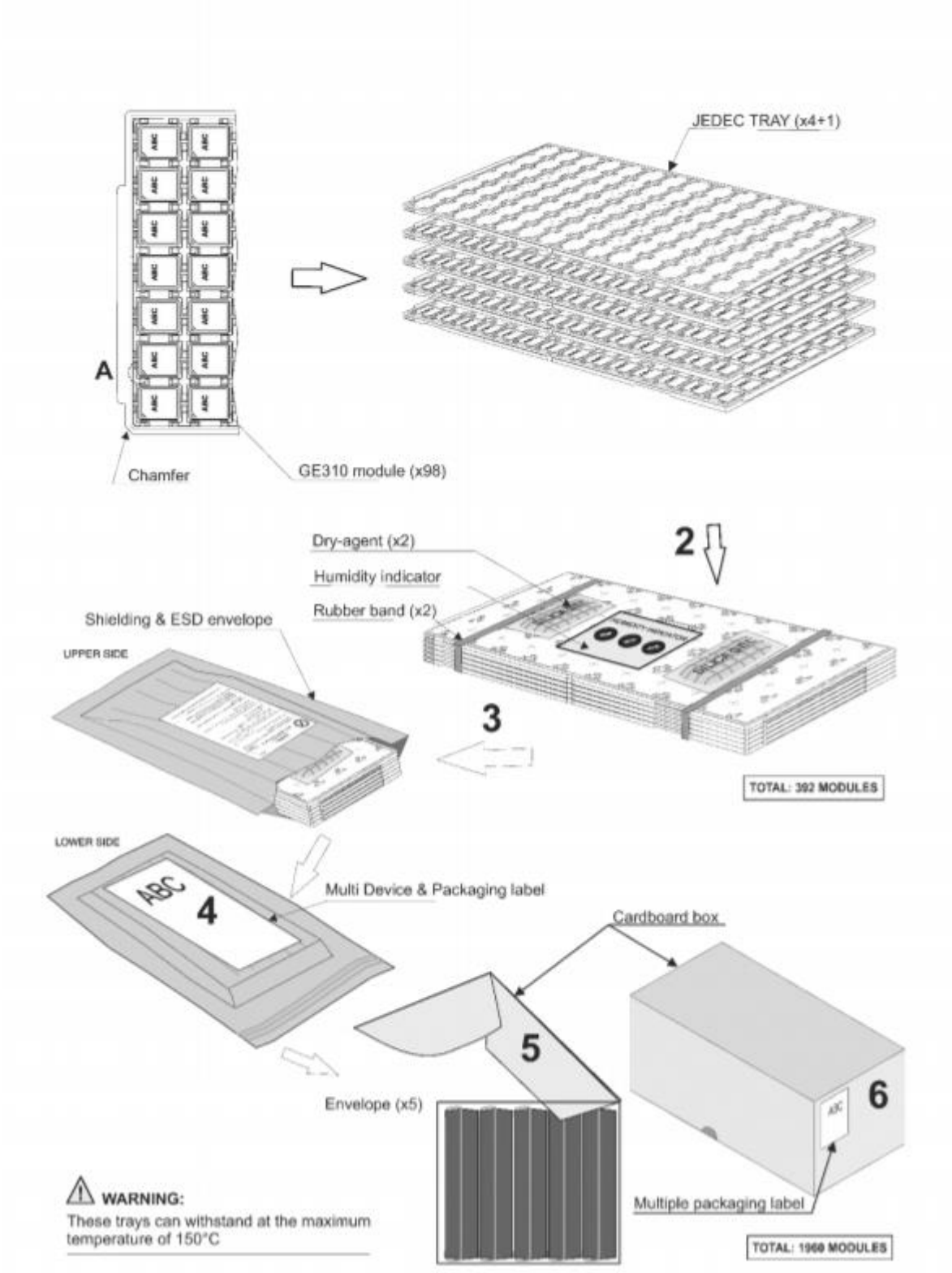


Figure 10: ME310M1-W1 and ME310M1-W2 Tray Packaging

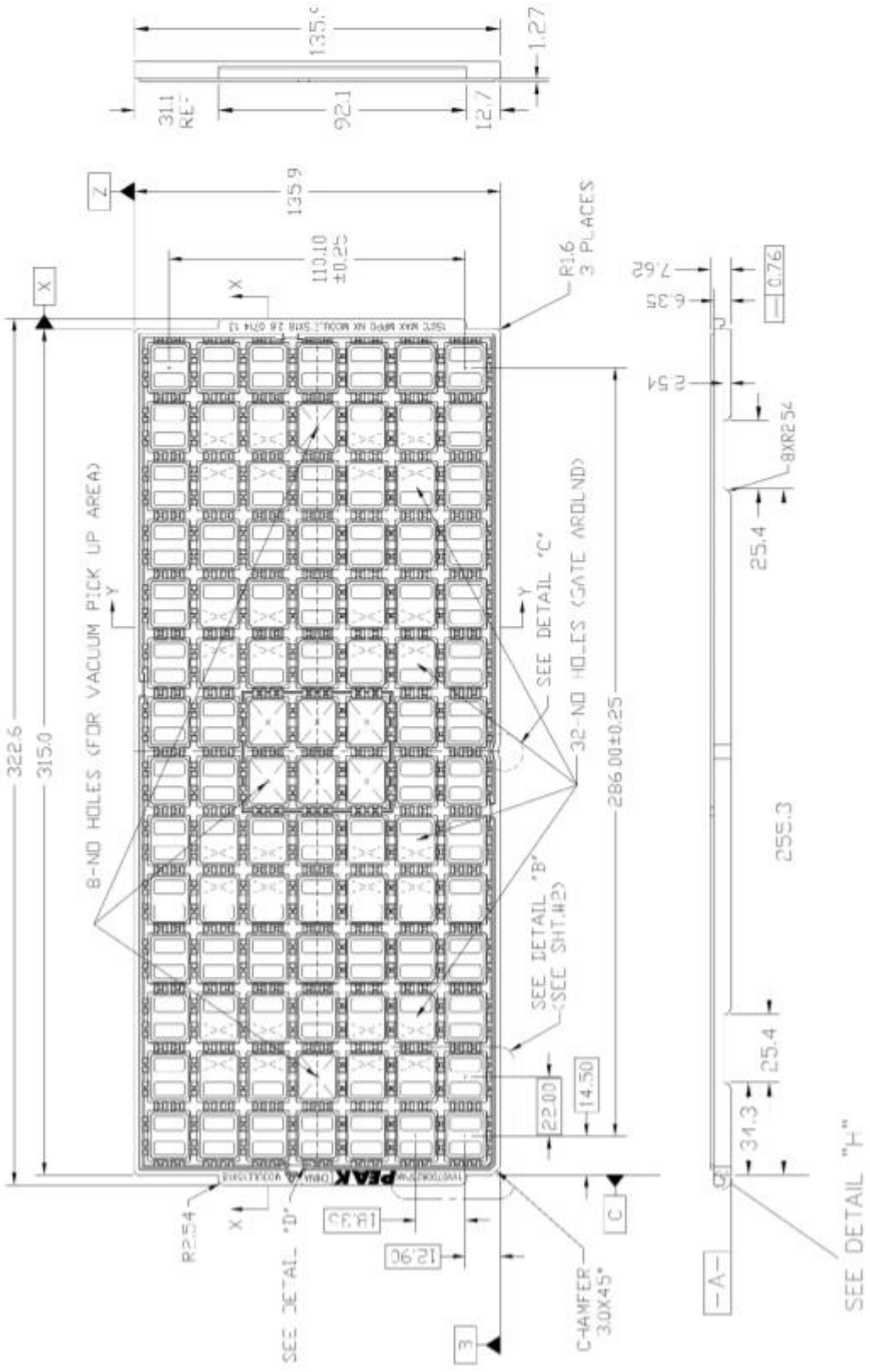


Figure 11: ME310M1-W1 and ME310M1-W2 Tray Dimensions

10.2 Reel

ME310M1-W1 and ME310M1-W2

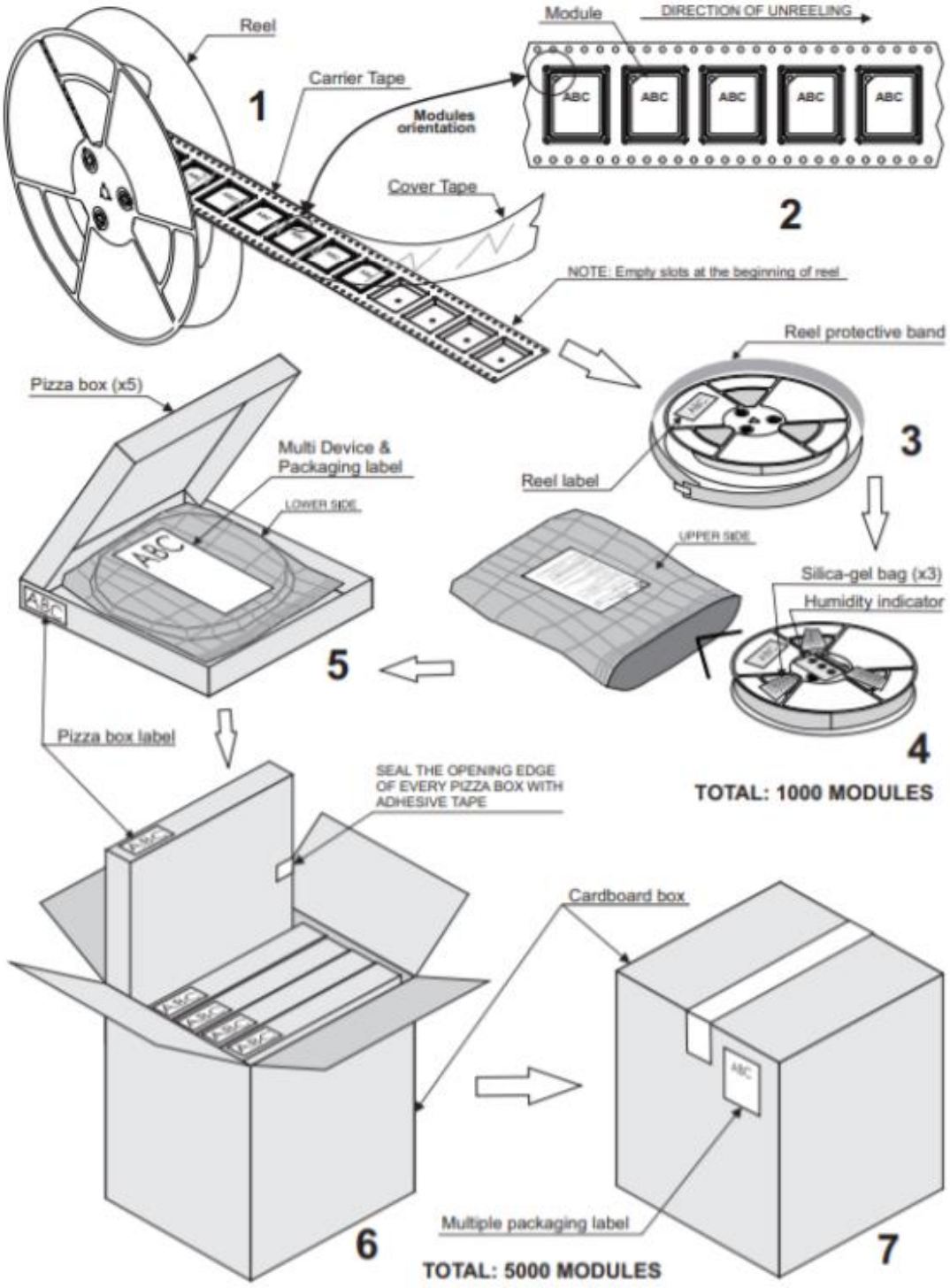


Figure 12: ME310M1-W1 and ME310M1-W2 Module Positioning into the Carrier

10.3 Moisture Sensitivity

The ME310M1 is a Moisture Sensitive Device level 3, according to standard IPC/JEDEC J-STD-020, and takes care of all the relative requirements for using this kind of component.

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

a Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH).

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

c The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition b) “IPC/JEDEC J-STD-033D 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.

11 Conformity Assessment Issues

11.1 Approvals Compliance Summary

Region	APAC					
Country & Type Approval	AU RCM	CH CCC	JP JRL / JTBL	KR KCC	SG IMDA	TW NCC
ME310M1-W1	🟡		🟡	🟡		
ME310M1-W2	🟡		🟡	🟡		

Table 30: APAC Compliance Summary

Region	EMEA			
Country & Type Approval	EU RED	UAE TRA	UK UKCA	ZA ICASA
ME310M1-W1	🟢		🟢	
ME310M1-W2	🟢		🟢	

Table 31: EMEA Compliance Summary

Region	Americas	
Country & Type Approval	CA ISED	US FCC
ME310M1-W1	🟢	🟢
ME310M1-W2	🟢	🟢

Table 32: Americas Compliance Summary

🟢	The equipment is compliant
🟡	Type approval is in progress
	The equipment is not compliant

Note: For approvals not included in the above, please contact Telit support.

11.2 APAC Approvals

Australia RCM

In accordance with the above Approval Compliance Summary table, where applicable (green ball), hereby, Telit Communications S.p.A declares that the equipment is in compliance with Regulatory Compliance Mark (RCM) of Australia.

NOTE: The equipment listed may not work when main power fails.

11.3 EMEA Approvals

EU RED

EU Declaration of Conformity

In accordance with the above Approval Compliance Summary table, where applicable (green ball), hereby, Telit Communications S.p.A declares that the equipment is in compliance with the Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address: https://www.telit.com/red

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

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

RED 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.

Model	Antenna Type
ME310M1-W1 **ME310M1-W2**	Omnidirectional Atel-Cab T-AT305 Antenna Gain 2.14 dBi in all bands

Table 33: Antenna Type used for RED module type approval

Max Gain for RED to respect MPE limits (dBi)		
Band	ME310M1-W1	ME310M1-W2
LTE FDD 1	11.85	11.85
LTE FDD 3	11.35	11.35
LTE FDD 8	8.46	8.46
LTE FDD 20	8.22	8.22
LTE FDD 28	7,49	7,49

Table 34: Maximum Antenna Gain for RED to respect MPE limits

UK UKCA

UKCA Declaration of Conformity

In accordance with the above Approval Compliance Summary table, where applicable (green ball), hereby, Telit Communications S.p.A declares that the equipment is in compliance with the Radio Equipment Regulations 2017 for UKCA.

The full text of the UKCA declaration of conformity is available at the following internet address: *https://www.telit.com/ukca*

The UKCA requirements can be found here:

https://www.gov.uk/guidance/using-the-ukca-marking

UK CA Antennas

This radio transmitter has been approved under UK CA 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 UK CA.

Model	Antenna Type
ME310M1-W1 ME310M1-W2	Omnidirectional Atel-Cab T-AT305 Antenna Gain 2.14 dBi in all abnds

Table 35: Antenna Type used for UKCA module type approval

Max Gain for UK CA to respect MPE limits (dBi)		
Band	ME310M1-W1	ME310M1-W2
LTE FDD 1	11.85	11.85
LTE FDD 3	11.35	11.35
LTE FDD 8	8.46	8.46
LTE FDD 20	8.22	8.22
LTE FDD 28	7,49	7,49

Table 36: Maximum Antenna Gain for UK CA to respect MPE limits

11.4 Americas Approvals

USA FCC

FCC Certificates

The FCC Grants can be found here: *https://www.fcc.gov/oet/ea/fccid*

Applicable FCC Rules

Model	Applicable FCC rules
ME310M1-W1	Title 47 CFR Part 22H, Part 24E, Part 27, Part 90, Part 15B
ME310M1-W2	

Table 37: Applicable FCC rules

FCC Regulatory Notices

INTEGRATION INSTRUCTIONS

This module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual, the following conditions must be strictly followed when using this certified module.

List of applicable FCC rules

Please refer to the Table 38.

Modification Statement

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

Interference Statement (if it is not placed in the device)

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

Wireless Notice

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This transmitter must not be co-located or operate 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

FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, according 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 per 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 the 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.

Information for the OEMs and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator but should not be distributed to the end user.

1. This device is intended for OEM integrators only.
2. Please see the full Grant of Equipment document for other restrictions

Manual Information to the End User

The OEM integrator should be aware not to provide information to the end user on how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warming as shown in this manual

Information on test modes and additional testing requirement

The module has been evaluated in mobile stand-alone conditions. For operational conditions other than 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.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only authorized by the FCC for the specific rule parts (for example, 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.

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Trace antenna designs

See 7.3 section for antenna and RF trace guidelines.

EMI Considerations

Please follow the guidance provided for host manufacturers in KDB publications 996369 D02 and D04.

How to make changes

Only Grantees are permitted to make permissive changes. Please contact us should the host integrator expect the module to be used differently than as granted:

Grantee code: RI7

Grantee name: Telit Communications S.p.A.

Mailing address: Viale Stazione di Prosecco 5/b, 34010 Sgonico – Trieste, Italy

Website: https://www.telit.com/

Support contact: TS-EMEA@telit.com

FCC Antenna info

This radio transmitter is sold without an antenna, and the antenna selection is up to the host device manufacturer.

This radio transmitter has been tested for FCC radio rules with the following antenna.

Model	Antenna Type
ME310M1-W1 **ME310M1-W2**	Omnidirectional Atel-Cab T-AT305 Antenna Gain 2.14 dBi in all bands

Table 38: Antenna Type used for FCC module type approval

This radio transmitter has been approved by FCC to operate with the antenna types listed below with the maximum allowable gain indicated. Antenna types not included in this list, with a gain greater than the maximum gain indicated for that type, are strictly prohibited from use with this device. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

Max Gain for FCC to meet MPE limits (dBi)			
Frequency Band	Freq [MHz]	ME310M1-W1	ME310M1-W2
LTE 71	663	8.4	8.4
LTE 85	698	8.6	8.6
LTE 12	699	8.6	8.6
LTE 13	777	9.1	9.1
LTE 14	788	9.2	9.2
LTE 5	824	9.4	9.3
LTE 26	824	9.4	9.3
LTE B106 (8A)	880	9.7	9.7
LTE 4	1710	5.0	5.0

LTE 66	1710	5.0	5.0
LTE 2 / 25	1850	8.0	8.0

Table 39: Maximum antenna gain for FCC (dBi) to meet ERP limits

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Labelling requirements for the host device

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as in the below table.

Model	Host device FCC label
ME310M1-W1	Contains FCC ID: RI7ME310M1WX
ME310M1-W2	

Table 40: FCC Labelling requirements for the host device

Canada ISED

ISED Database

The products ISED certified can be found here:
Les produits certifiés ISED peuvent être trouvés ici :
https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1&lang=en

Applicable ISED Rules

Model	Applicable ISED rules
ME310M1-W1	RSS-130 Issue 2, RSS-132 Issue 4, RSS-133 Issue 6, RSS-139 Issue 4, RSS-140 Issue 1, ICES-003 Issue 7
ME310M1-W2	

Table 41: Applicable ISED rules

ISED Regulatory Notices / Avis réglementaires de 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 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 present appareil est conforme aux applicables RSS standards d'Industrie Canada. 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.

Radio Exposure Notice / *Avis d'exposition radio*

This device complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets the RSS-102 of the ISED radio frequency (RF) Exposure rules. Antenna gain must be less than the values reported in the table below:

Le present 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. Gain de l'antenne doit être ci-dessous:

Max Gain for ISED to meet ERP and MPE limits (dBi) / *Gain d'antenne maximal pour ISDE pour respecter les limites ERP et MPE (dBi)*			
Frequency Band	Freq [MHz]	ME310M1-W1	ME310M1-W2
LTE 71	663	5.4	5.4
LTE 85	698	5.6	5.6
LTE 12	699	5.6	5.6
LTE 13	777	5.9	5.9
LTE 14	788	5.9	5.9
LTE 5	824	6.0	6.0
LTE 26	824	6.0	6.0
LTE B106 (8A)	898	6.3	6.3
LTE 4	1710	5.0	5.0
LTE 66	1710	5.0	5.0
LTE 2	1850	8.0	8.0
LTE 25	1850	8.0	8.0

Table 42: Max Gain for ISED to meet ERP limits (dBi) / Gain d'antenne maximal pour ISDE pour respecter les limites ERP (dBi)

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

This equipment must be installed and operated in accordance with provided instructions and 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 consider removing the no-collocation statement.

Cet équipement doit être installé et utilisé conformément aux instructions fournies et la ou les antennes utilisées pour cet émetteur doivent être installées pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doivent pas être co-localisées ou fonctionner en conjonction avec toute autre antenne ou émetteur. Les utilisateurs finaux et les installateurs doivent recevoir les instructions d'installation de l'antenne et envisager de supprimer la déclaration de non-collocation.

ISED Antenna info

This radio transmitter is sold without an antenna, and the antenna selection is up to the host device manufacturer.

Cet émetteur radio est vendu sans antenne et le choix de l'antenne appartient au fabricant de l'appareil hôte.

This radio transmitter has been tested with the following antenna.

Cet émetteur radio a été testé avec l'antenne suivante.

Model	Antenna Type
ME310M1-W1 **ME310M1-W2**	Omnidirectional Atel-Cab T-AT305 Antenna Gain 2.14 dBi in all bands

Table 43: Antenna Type used for ISED module type approval / Type d'antenne utilisé pour l'approbation de type de module ISDE

Trace antenna designs

See 7.3 section for antenna and RF trace guidelines.

Voir la section 7.3 pour les directives relatives à l'antenne et au tracé RF.

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

The module has been evaluated in mobile stand-alone conditions. For operational conditions other than 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 IC RSS-102.

Le module a été évalué dans des conditions mobiles autonomes. Pour des conditions de fonctionnement autres qu'un émetteur modulaire autonome dans un hôte (plusieurs modules transmettant simultanément ou d'autres émetteurs dans un hôte), des tests supplémentaires peuvent être nécessaires (colocalisation, retest...) Si ce module est destiné à être utilisé dans un appareil portable , vous êtes responsable de l'approbation séparée pour satisfaire aux exigences SAR IC RSS-102.

Labelling requirements for the host device / Exigences d'étiquetage pour le périphérique hôte

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the IC of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as in the following table.

L'appareil hôte doit être étiqueté comme il faut pour permettre l'identification des modules qui s'y trouvent. L'étiquette de certification du module donné doit être posée sur l'appareil hôte à un endroit bien en vue en tout temps. En l'absence d'étiquette, l'appareil hôte doit porter une étiquette donnant le IC du module, précédé des mots « Contient un module d'émission », du mot « Contient » ou d'une formulation similaire exprimant le même sens, comme en tableau suivant.

Model / HVIN	Host device ISED label
ME310M1-W1	Contains IC: 5231A-ME310M1WX
ME310M1-W2	

Table 44: ISED Labelling requirements for the host device / ISDE étiquetage pour le périphérique hôte

CAN ICES-3 (B) / NMB-3 (B)

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

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

12 Acronyms and Abbreviations

Table 45: Acronyms and Abbreviations

Acronym	Definition
ADC	Analog – Digital Converter
BPSK	Modulation used for in OFDM symbols
CLK	Clock
CMOS	Complementary Metal – Oxide Semiconductor
CS	Chip Select
DAC	Digital – Analog Converter
DTE	Data Terminal Equipment
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESR	Equivalent Series Resistance
FDD	Frequency Division Duplexing
GPIO	General Purpose Input Output
HS	High Speed
HSDPA	High Speed Downlink Packet Access
HSIC	High Speed Inter Chip
HSUPA	High Speed Uplink Packet Access
I/O	Input Output
LTE	Long Term Evolution
MISO	Master Input – Slave Output
MOSI	Master Output – Slave Input
NAS	Non-Access Stratum
PCB	Printed Circuit Board
PSM	Power Saving Mode according to 3GPP Rel.12
QPSK	Modulation used for in OFDM symbols
RB	Resource Block; the smallest unit of resources that can be allocated to a user
RF	Radio Frequency
RMC	Reference Measurement Channel; it refers to a 3GPP standardized setting for the channel. For more details, refer to 3GPP TS 36.521-1
RTC	Real Time Clock
RU	Resource Unit (NB IoT Only); the time reported is the length for the specific configuration SC - SC Spacing
SC	Sub Carriers: indicates the number of Sub-Carriers used
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
UARTto	Universal Asynchronous Receiver Transmitter
VSWR	Voltage Standing Wave Radio

13 Related Documents

Refer to https://dz.telit.com/ for current documentation and downloads.

Table 46: Related Documents

S.no	Doc Code	Document Title
1	80668ST11067A	ME310M1 AT Commands Reference Guide

14 Document History

Table 47: Document History

Revision	Date	Changes
1	2024-05-27	• Pinout changed according to DVT HW • Minor document format corrections • Upadate Section 11 Conformity Assessment Issues
0	2023-11-23	Initial release

From Mod.0818 Rev.12