ME910G1

HW Design Guide

1VV0301593 Rev. 15 – 2022-08-23

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS
ME910G1-W1
ME910G1-WW
ME910G1-WWV
ME910G1-W3

CONTENTS

1. INTRODUCTION

1.1. Scope

This document describes the electrical specifications, mechanical information, interface application, and manufacturing information of the Telit ME910G1 module. With the help of this document and other application notes or user guides, users can understand the Telit ME910G1 module well and quickly develop various products.

1.2. Audience

This document is intended system integrators who use the Telit ME910G1 module in their products.

1.3. Contact Information, Support

For technical queries, support services, and to share documentation feedback, contact Telit Technical Support at:

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

Alternatively, you may visit:

https://www.telit.com/contact-us/

For more information about Telit modules, visit:

https://www.telit.com

1.4. 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.
⚠	**Electro-static Discharge:** Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

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

1.5. Related Documents

- 80617ST10991A - ME310G1/ME910G1/ML865G1 AT Commands Reference Guide
- 80529NT11661A - Cat M/NB-IoT Quick Start Guide
- 1VV0300989 - SSL/TLS User Guide
- 80000NT10001A - SIM INTEGRATION DESIGN GUIDES Application Note
- 80000NT10060A - xE910 Global Form Factor Application Note
- 80000NT10002A - ANTENNA DETECTION
- 80000NT10003A - Rework procedure for BGA modules
- 80000NT10028A - Event Monitor Application Note

2. GENERAL PRODUCT DESCRIPTION

2.1. Overview

The ME910G1 module is a CATM/ NBIoT communication product that allows integrators to plan availability for lifecycle applications, highly recommended for new designs specified for worldwide coverage.

The ME910G1-WWV product is fully voice capable, the digital audio interface make it suitable for applications such as voice enabled alarm panels, mHealth patient monitors and special phones such as those for the elderly or sensory-impaired. The ME910G1 operates with 1.8 V GPIOs, minimizing power consumption and making it even more ideal for application with battery powered and wearable device.

2.2. Product Variants and Frequency Bands

Product	HW Rev	2G Band (MHz)	LTE CATM1	NBIoT	CS Voice VoLTE	External Antenna Tuner Support	Region
ME910G1-W1	0.0	-	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d*	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85, B86*, B8_39d*	N	Y	Worldwide
ME910G1-WW	0.0	850, 900, 1800, 1900	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d*	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85, B86*, B8_39d*	N	N	Worldwide
	1.0					Y	
ME910G1-WWV	1.0	850, 900, 1800, 1900	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85	-	Y	Y	Worldwide

Product	HW Rev	2G Band (MHz)	LTE CATM1	NBIoT	CS Voice VoLTE	External Antenna Tuner Support	Region
ME910G1-W3	0.0		B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d*		N	N	Worldwide

Table 2: Product Variants and Frequency Bands ** See notes below*

Refer to "RF Section" for details information about frequencies and bands.

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

Note: "B86" has been 3GPP standardized as B103. In AT commands and in FW we continue to use the "B86" reference.

UL range: 787-788 MHz, DL range: 757-758 MHz that is available only in module where AT#BNDOPTIONS command contains the string B86. that is AT#BNDOPTIONS?

#BNDOPTIONS: 1,2,3,4,5,8,12,13,18,19,20,25,26,27,28,66,71,85,86

Note: "B8_39d" is not a 3GPP band, it means the following:

U.S. FCC 900MHz that employs 39MHz duplexing

UL range: 897.5-900.5MHz, DL range: 936.5-939.5

It is available only in module where AT#BNDOPTIONS command contains the string B8_39d. that is AT#BNDOPTIONS?

#BNDOPTIONS: 1,2,3,4,5,8,12,13,18,19,20,25,26,27,28,66,71,85, B8_39d

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2.3. Target Market

The Telit ME910G1 can be used for telematics applications where tamper-resistance, confidentiality, integrity, and authenticity of end-user information are required, for example:

- Telematics services
- Road pricing
- Pay-as-you-drive insurance
- Stolen vehicles tracking
- Internet connectivity

2.4. Main Features

Function	Features
Modem	• CATM and NBIoT technologies • SMS support (text and PDU) • Alarm management • Real Time Clock
Interfaces	• USB 2.0 HS (AT command [1] , FW upgrade and module diagnostic) • USIF0 Main UART (AT command [1] and FW upgrade) • USIF1 Auxiliary UART (AT Command [1], AppZone diagnostic) • 10 GPIOs • Antenna port

Table 3: Functional features

[1] Functionality depending on ports configuration

2.5. TX Output Power

2.5.1. ME910G1-W1

Band	Mode	3GPP Class	RF power (dBm) Nominal*
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d	(LTE) CAT-M1	5	21
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85, B86, B8_39d	(LTE) CAT-NB2	5	21

Table 4: Transmission Output power

2.5.2. ME910G1-WW

Band	Mode	Class	RF power (dBm) Nominal*
850/900MHz	GSM/GPRS	4	32.5
	EGPRS	E2	27
1800/1900MHz	GSM/GPRS	1	29.5
	EGPRS	E2	26

Band	Mode	Class	RF power (dBm) Nominal*
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d	(LTE) CAT-M1	3	23
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85, B86, B8_39d	(LTE) CAT-NB2	3	23
B71	(LTE) CAT-NB2	5	21

Table 5: Transmission Output power ME910G1-WW
** Max output power tolerance range according to 3GPP TS 36.521-1 and 3GPP TS 51.010-1 or better*

2.5.3. ME910G1-WWV

Band	Mode	Class	RF power (dBm) Nominal*
850/900MHz	GSM/GPRS	4	32.5
	EGPRS	E2	27
1800/1900MHz	GSM/GPRS	1	29.5
	EGPRS	E2	26
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B85	(LTE) CAT-M1	3	23
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85	(LTE) CAT-NB2	3	23
B71	(LTE) CAT-NB2	5	21

Table 6: Transmission Output power ME910G1-WWV
** Max output power tolerance range according to 3GPP TS 36.521-1 and 3GPP TS 51.010-1 or better*

2.5.4. ME910G1-W3

Band	Mode	3GPP Class	RF power (dBm) Nominal*
B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85, B8_39d	(LTE) CAT-M1	3	23

Table 7: Transmission Output power ME910G1-W3
** Max output power tolerance range according to 3GPP TS 36.521-1 and 3GPP TS 51.010-1 or better*

2.6. RX Sensitivity

2.6.1. ME910G1-W1

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP limit
CATM1 / Band1	-107.6	-102.7
CAT M1 / Band2	-108.0	-100.3
CAT M1 / Band3	-107.6	-99.3
CAT M1 / Band4	-107.8	-102.3
CAT M1 / Band5	-107.9	-100.8
CAT M1 / Band8	-107.8	-99.8
CAT M1 / Band12	-107.8	-99.3
CAT M1 / Band13	-108.0	-99.3
CAT M1 / Band18	-108.0	-102.3
CAT M1 / Band19	-108.0	-102.3
CAT M1 / Band20	-107.8	-99.8
CAT M1 / Band25	-108.0	-
CAT M1 / Band26	-108.0	-100.3
CAT M1 / Band27	-108.0	-100.8
CAT M1 / Band28	-107.9	-100.8
CAT M1 / Band66	-107.8	-
CAT M1 / Band85	-107.6	-
CAT NB2 / Band1	-116.8	-108.2
CAT NB2 / Band2	-116.8	-108.2
CAT NB2 / Band3	-116.8	-108.2
CAT NB2 / Band4	-116.7	-
CAT NB2 / Band5	-116.7	-108.2
CAT NB2 / Band8	-116.4	-108.2
CAT NB2 / Band12	-116.8	-108.2
CAT NB2 / Band13	-116.8	-108.2
CAT NB2 / Band18	-116.8	-108.2
CAT NB2 / Band19	-116.8	-108.2

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP limit
CAT NB2 / Band20	-116.6	-108.2
CAT NB2 / Band25	-116.8	-
CAT NB2 / Band26	-116.8	-108.2
CAT NB2 / Band28	-116.9	-108.2
CAT NB2 / Band66	-116.6	-108.2
CAT NB2 / Band71	-115.4	-
CAT NB2 / Band85	-116.8	-

Table 8: RX Sensitivity ME910G1-W1
** 3GPP TS 36.521-1 Release 15 Minimum performance requirement*

2.6.2. ME910G1-WW and ME910G1-WWV

Band	REFsens (dBm) Typical	3GPP REFsens (dBm)* 3GPP limit
CATM1 / Band1	-106.3	-102.7
CAT M1 / Band2	-107.3	-100.3
CAT M1 / Band3	-106.6	-99.3
CAT M1 / Band4	-106.7	-102.3
CAT M1 / Band5	-107.1	-100.8
CAT M1 / Band8	-107.3	-99.8
CAT M1 / Band12	-106.5	-99.3
CAT M1 / Band13	-107.9	-99.3
CAT M1 / Band18	-107.6	-102.3
CAT M1 / Band19	-106.8	-102.3
CAT M1 / Band20	-107.4	-99.8
CAT M1 / Band25	-107.0	-
CAT M1 / Band26	-107.0	-100.3
CAT M1 / Band27	-107.4	-100.8
CAT M1 / Band28	-107.8	-100.8
CAT M1 / Band66	-106.7	-
CAT M1 / Band85	-105.3	-
CAT NB2 / Band1	-115.4	-108.2

Band	REFsens (dBm) Typical	3GPP REFsens (dBm)* 3GPP limit
CAT NB2 / Band2	-116.2	-108.2
CAT NB2 / Band3	-116.4	-108.2
CAT NB2 / Band4	-115.6	-
CAT NB2 / Band5	-116.5	-108.2
CAT NB2 / Band8	-115.9	-108.2
CAT NB2 / Band12	-116.6	-108.2
CAT NB2 / Band13	-116.8	-108.2
CAT NB2 / Band18	-116.6	-108.2
CAT NB2 / Band19	-116.4	-108.2
CAT NB2 / Band20	-116.0	-108.2
CAT NB2 / Band25	-116.2	-
CAT NB2 / Band26	-116.1	-108.2
CAT NB2 / Band28	-116.8	-108.2
CAT NB2 / Band66	-115.6	-108.2
CAT NB2 / Band71	-113.7	-
CAT NB2 / Band85	-116.0	-
GPRS / GSM850	-110.0	-104.0
GPRS / GSM900	-110.0	-104.0
GPRS / DCS1800	-109.6	-104.0
GPRS / PCS1900	-109.0	-104.0

Table 9: RX Sensitivity ME910G1-WW and ME910G1-WWV
** 3GPP TS 36.521-1 Release 15 Minimum performance requirement*

***GPRS sensitivity table using GMSK CS2: *BLER <10%, CS2 According to 3GPP 51.010-1*

2.6.3. ME910G1-W3

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP limit
CATM1 / Band1	-107.5	-102.7
CAT M1 / Band2	-107.6	-100.3
CAT M1 / Band3	-105.7	-99.3
CAT M1 / Band4	-107.6	-102.3

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP limit
CAT M1 / Band5	-106.7	-100.8
CAT M1 / Band8	-107.0	-99.8
CAT M1 / Band12	-106.7	-99.3
CAT M1 / Band13	-107.5	-99.3
CAT M1 / Band14	-107.6	-99.3
CAT M1 / Band18	-107.5	-102.3
CAT M1 / Band19	-107.1	-102.3
CAT M1 / Band20	-107.0	-99.8
CAT M1 / Band25	-107.4	-100.3
CAT M1 / Band26	-106.9	-100.3
CAT M1 / Band27	-107.0	-100.8
CAT M1 / Band28	-106.9	-100.8
CAT M1 / Band66	-107.4	-102.3
CAT M1 / Band85	-106.3	-99.3
CAT M1 / Band8_39d	-107.4	-99.8

Table 10: RX Sensitivity ME910G1-W3

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

2.7. Mechanical Specifications

2.7.1. Dimensions

The overall dimensions of ME910G1-W1, ME910G1-WW, ME910G1-WWV and ME910G1-W3 without label applied are:

- Length: 28.2 mm
- Width: 28.2 mm
- Thickness: 2.4 mm

2.7.2. Weight

The nominal weight of the ME910G1-W1 is 3.5 gr.

The nominal weight of the ME910G1-WW and ME910G1-WW is 4 gr.

2.8. Temperature Range

Temperature Range		Note
Operating Temperature Range	−40°C to +85°C	The module is fully functional (*) and compliant according to regulatory standards.
Storage Temperature Range	−40°C to +105°C	The module is not powered and not connected to power supply

Table 11: Temperature Range

Note: (*) Functional: if applicable, the module can make and receive voice calls, data calls, send and receive SMS and data traffic.

3. PINS ALLOCATION

3.1. Pin-out

Pin	Signal	I/O	Function	Type	Comment
USB HS 2.0 COMMUNICATION PORT (FW upgrade and Data)					
B15	USB_D+	I/O	USB differential Data (+)		
C15	USB_D-	I/O	USB differential Data (-)		
A13	VUSB	I	Enable pin for the internal USB transceiver.	5 / 3V	Internal PD (100K)
Asynchronous Serial Port (USIF0) (FW upgrade and Data with Flow Control)					
N15	C103/TXD	I	Serial data input from DTE	CMOS 1.8V	internal PU (100k)
M15	C104/RXD	O	Serial data output to DTE	CMOS 1.8V	
M14	C108/DTR	I	Input for (DTR) from DTE	CMOS 1.8V	internal PU (100k)
L14	C105/RTS	I	Input for Request to send signal (RTS) from DTE	CMOS 1.8V	internal PU (100k)
P15	C106/CTS	O	Output for Clear to Send signal (CTS) to DTE	CMOS 1.8V	
N14	C109/DCD	O	Output for (DCD) to DTE	CMOS 1.8V	
P14	C107/DSR	O	Output for (DSR) to DTE	CMOS 1.8V	
R14	C125/RING	O	Output for Ring (RI) to DTE	CMOS 1.8V	
SIM Card Interface					
A6	SIMCLK	O	External SIM signal – Clock	1.8V	
A7	SIMRST	O	External SIM signal – Reset	1.8V	
A5	SIMIO	I/O	External SIM signal – Data I/O	1.8V	
A4	SIMIN	I	External SIM signal – Presence (active low)	CMOS 1.8	Internal PU (470K)
A3	SIMVCC	-	External SIM signal – Power supply for the SIM	1.8V	
Digital Voice Interface (DVI)					
B9	DVI_WA0	I/O	Digital Audio Interface (WA0)	1.8V	
B6	DVI_RX	I	Digital Audio Interface (RX)	1.8V	

Pin	Signal	I/O	Function	Type	Comment
B7	DVI_TX	I/O	Digital Audio Interface (TX)	1.8V	
B8	DVI_CLK	I/O	Digital Audio Interface (CLK)	1.8V	
SPI					
D15	SPI_MOSI	I/O	SPI MOSI	CMOS 1.8V	
E15	SPI_MISO	I/O	SPI_MISO	CMOS 1.8V	
F15	SPI_CLK	I/O	SPI Clock	CMOS 1.8V	
H14	SPI_CS	I/O	SPI Chip Select	CMOS 1.8V	
DIGITAL IO					
C8	GPIO_01	I/O	GPIO_01 /STAT LED	CMOS 1.8V	STAT LED is alternate function internal PD (100K)
C9	GPIO_02	I/O	GPIO_02	CMOS 1.8V	internal PD (100K)
C10	GPIO_03	I/O	GPIO_03	CMOS 1.8V	internal PD (100K)
C11	GPIO_04	I/O	GPIO_04	CMOS 1.8V	internal PD (100K)
B14	GPIO_05	I/O	GPIO_05	CMOS 1.8V	internal PD (100K)
C12	GPIO_06	I/O	GPIO_06	CMOS 1.8V	internal PD (100K)
C13	GPIO_07	I/O	GPIO_07	CMOS 1.8V	internal PD (100K)
K15	GPIO_08	I/O	GPIO_08	CMOS 1.8V	internal PD (100K)
L15	GPIO_09	I/O	GPIO_09	CMOS 1.8V	internal PD (100K)
G15	GPIO_10	I/O	GPIO_10	CMOS 1.8V	internal PD (100K)
ADC					
B1	ADC_IN	AI	Analog Digital Converter input		
RF SECTION					
K1	ANTENNA	I/O	LTE Antenna (50 ohm)	RF	

Pin	Signal	I/O	Function	Type	Comment
GNSS Section					
R9	ANT_GNSS	I	GNSS Antenna (50 ohm)	RF	
R7	GNSS_LNA_EN	O	External GNSS LNA Enable	CMOS 1.8V	
Miscellaneous Functions					
R13	HW_SHUTDOWN*	I	HW Unconditional Shutdown	VBATT	Active low
R12	ON_OFF*/WAKE*	I	Input command for power ON and to wake from deep sleep mode	1.8V	Active low
R11	VAUX/PWRMON	O	Supply Output for external accessories / Power ON Monitor	1.8V	
F14	FORCED_USB_BOOT	I	Debug pin, connect to test point	CMOS 1.8V	Active high, internal PD (100K)
Power Supply					
M1	VBATT	-	Main power supply (Baseband)	Power	
M2	VBATT	-	Main power supply (Baseband)	Power	
N1	VBATT_PA	-	Main power supply (Radio PA)	Power	
N2	VBATT_PA	-	Main power supply (Radio PA)	Power	
P1	VBATT_PA	-	Main power supply (Radio PA)	Power	
P2	VBATT_PA	-	Main power supply (Radio PA)	Power	
Antenna Tuner Section (Only on HW1.0)					
K3	ATC2/MIPI_DATA	O	Antenna Tuner Ctrl		Only on HW1.0
L3	ATC1/MIPI_CLK	O	Antenna Tuner Ctrl		Only on HW1.0
GND					
E1	GND	-	Ground	Power	
G1	GND	-	Ground	Power	
H1	GND	-	Ground	Power	
J1	GND	-	Ground	Power	
L1	GND	-	Ground	Power	
A2	GND	-	Ground	Power	
E2	GND	-	Ground	Power	
F2	GND	-	Ground	Power	
G2	GND	-	Ground	Power	

Pin	Signal	I/O	Function	Type	Comment
H2	GND	-	Ground	Power	
J2	GND	-	Ground	Power	
K2	GND	-	Ground	Power	
L2	GND	-	Ground	Power	
R2	GND	-	Ground	Power	
M3	GND	-	Ground	Power	
N3	GND	-	Ground	Power	
P3	GND	-	Ground	Power	
R3	GND	-	Ground	Power	
D4	GND	-	Ground	Power	
M4	GND	-	Ground	Power	
N4	GND	-	Ground	Power	
P4	GND	-	Ground	Power	
R4	GND	-	Ground	Power	
N5	GND	-	Ground	Power	
P5	GND	-	Ground	Power	
R5	GND	-	Ground	Power	
N6	GND	-	Ground	Power	
P6	GND	-	Ground	Power	
R6	GND	-	Ground	Power	
P8	GND	-	Ground	Power	
R8	GND	-	Ground	Power	
P9	GND	-	Ground	Power	
P10	GND	-	Ground	Power	
R10	GND	-	Ground	Power	
M12	GND	-	Ground	Power	
B13	GND	-	Ground	Power	
P13	GND	-	Ground	Power	
E14	GND	-	Ground	Power	
RESERVED					
C1	RESERVED	-	RESERVED		

Pin	Signal	I/O	Function	Type	Comment
D1	RESERVED	-	RESERVED		
F1	RESERVED	-	RESERVED		
B2	RESERVED	-	RESERVED		
C2	RESERVED	-	RESERVED		
D2	RESERVED	-	RESERVED		
B3	RESERVED	-	RESERVED		
C3	RESERVED	-	RESERVED		
D3	RESERVED	-	RESERVED		
E3	RESERVED	-	RESERVED		
F3	RESERVED	-	RESERVED		
G3	RESERVED	-	RESERVED		
K3	RESERVED	-	RESERVED		Only on HW0.0
L3	RESERVED	-	RESERVED		Only on HW0.0
B4	RESERVED	-	RESERVED		
C4	RESERVED	-	RESERVED		
B5	RESERVED	-	RESERVED		
C5	RESERVED	-	RESERVED		
C6	RESERVED	-	RESERVED		
C7	RESERVED	-	RESERVED		
N7	RESERVED	-	RESERVED		
P7	RESERVED	-	RESERVED		
N8	RESERVED	-	RESERVED		
N9	RESERVED	-	RESERVED		
A10	RESERVED	-	RESERVED		
N10	RESERVED	-	RESERVED		
N11	RESERVED	-	RESERVED		
P11	RESERVED	-	RESERVED		
B12	RESERVED	-	RESERVED		
D12	RESERVED	-	RESERVED		
N12	RESERVED	-	RESERVED		
P12	RESERVED	-	RESERVED		

Pin	Signal	I/O	Function	Type	Comment
G14	RESERVED	-	RESERVED		
J14	RESERVED	-	RESERVED		
K14	RESERVED	-	RESERVED		
N13	RESERVED	-	RESERVED		
L13	RESERVED	-	RESERVED		
J13	RESERVED	-	RESERVED		
M13	RESERVED	-	RESERVED		
K13	RESERVED	-	RESERVED		
H13	RESERVED	-	RESERVED		
G13	RESERVED	-	RESERVED		
F13	RESERVED	-	RESERVED		
B11	RESERVED	-	RESERVED		
B10	RESERVED	-	RESERVED		
A9	RESERVED	-	RESERVED		
A8	RESERVED	-	RESERVED		
E13	RESERVED	-	RESERVED		
D13	RESERVED	-	RESERVED		
D14	RESERVED	-	RESERVED		
A14	RESERVED	-	RESERVED		
A12	RESERVED	-	RESERVED		
A11	RESERVED	-	RESERVED		
H15	RESERVED	-	RESERVED		
J15	RESERVED	-	RESERVED		
C14	RESERVED	-	RESERVED		
H3	RESERVED	-	RESERVED		
J3	RESERVED	-	RESERVED		

Table 12: Pin-out Information

Warning: Reserved pins must not be connected.

Only D13-E13 pins can be connected together in order to be compatible with HE910 module. All pull-up (PU) and pull-down (PD) are about 100K

3.2. LGA Pads Layout

TOP VIEW

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1		ADC_IN1	RES	RES	GND	RES	GND	GND	GND	ANT	GND	VBATT	VBATT_PA	VBATT_PA	
2	GND	RES	RES	RES	GND	GND	GND	GND	GND	GND	GND	VBATT	VBATT_PA	VBATT_PA	GND
3	SIMVCC	RES	RES	RES	RES	RES	RES	RES	RES	ATC1 MIPI_DATA	ATC2 MIPI_CLK	GND	GND	GND	GND
4	SIMIN	RES	RES	GND								GND	GND	GND	GND
5	SIMIO	RES	RES										GND	GND	GND
6	SIMCLK	DVI_RX	RES										GND	GND	GND
7	SIMRST	DVI_TX	RES										RES	RES	GNSS_LNA_EN
8	RES	DVI_CLK	GPIO_01										RES	GND	GND
9	RES	DVI_WA0	GPIO_02										RES	GND	ANT_GNSS
10	RES	RES	GPIO_03										RES	GND	GND
11	RES	RES	GPIO_04										RES	RES	VAUX/PWRMON
12	RES	RES	GPIO_06	RES								GND	RES	RES	ON_OFF*/WAKE*
13	VUSB	GND	GPIO_07	RES	RES	RES	RES	RES	RES	RES	RES	RES	RES	GND	HW_SHUTDOWN*
14	RES	GPIO_05	RES	RES	GND	FORCE_USB_BOOT	RES	SPI_CS	RES	RES	C105/RTS	C108/DTR	C109/DCD	C107/DSR	C125/RING
15		USB_D+	USB_D-	SPI_MOSI TX_AUX	SPI_MISO RX_AUX	SPI_CLK	GPIO_10	RES	RES	GPIO_08	GPIO_09	C104/RXD	C103/TXD	C106/CTS	

Figure 1: LGA Pads Layout

4. POWER SUPPLY

The power supply circuit and board layout are an important part of the product design. Make sure to follow the guidelines and requirements for optimal performance .

4.1. Power Supply Requirements

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

Power Supply	Value
Nominal Supply Voltage	3.8V
Operating Voltage Range	3.2 V - 4.2 V
Extended Voltange Range	2.6 V - 4.5 V
$VBATT_{min}$	2.7V

Table 13: Power Supply Requirements

Warning: The range 2.6V - 3.2V can be used only if both USB and 2G are disabled.

Warning: The modem supply voltage must never exceed the Extended Operating Voltage Range.

Inaccurate implementation of power supply guidelines described in this document can cause a faulty module.

Note: For PTCRB approval on the final products the power supply must be within the “Operating Voltage Range”.

Note: The power supply section of the application must be carefully designed to avoid excessive voltage drop during peak transmission current absorptions. If the voltage drops beyond the limits of the Extended Operating Voltage range, an unintentional module power off can occur.

Note: When turning on the modem, the voltage must be at least VBATTmin.

Note: The HardwareUser Guide specifications must be recognized and carefully implemented to use the module in its "Extended Operating Voltage Range".

4.2. Power Consumption

4.2.1. Idle Mode

Mode	Measure (Typical)			Mode Description
Switched Off	3uA			Module switched off after switched it on (after power supplied, without power cycle on and off, 13uA)
IDLE mode	CATM (mA)	NBIoT (mA)	2G (mA)	
AT+CFUN=1	9.5	9.2	9.0	Normal mode: full functionality of the module
AT+CFUN=4	7.5			Disabled TX and RX; module is not registered on the network
AT+CFUN=5	1.20	0.95	-	Paging cycle #256 frames (2.56s DRx cycle)
	0.60	0.60	-	81.92s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	0.18[1]	0.18[1]	-	327.68s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	0.10[1]	0.10[1]	-	655.36s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	0.05[1]	0.05[1]	-	1310.72s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	0.03[1]	0.03[1]	-	2621.44s eDRx cycle length (PTW=2.56s, DRX=1.28s)
	-	-	0.90	Paging Multiframe 9
PSM mode	Typical (mA)			
AT+CPSMS=1	3uA			No current source or sink by any connected pin

Table 14: Idle and PSM Mode

[1] PSM in between eDRX

Mode		Measure* (Typical)	Mode Description
GPS		(mA)	
Active State (GNSS ON, CFUN=4)	Acquisition	69.3	GPS+GLO, DPO off
	Navigation	22	GPS+GLO, DPO on DWELL=280ms
		55.9	GPS+GLO, DPO off
Active State (GNSS ON, CFUN=5 eDRX)	Acquisition	68.5	GPS+GLO, DPO off
	Navigation	15.7	GPS+GLO, DPO on DWELL=280ms
		54	GPS+GLO, DPO off

Table 15:GPS Mode **reference signal @-130 dbm with static scenario*

Note: The reported LTE CAT M1 and LTE CAT NB1 idle mode values are an average among all product variants and bands for each network wireless technology.

Support of specific network wireless technology depends on the product variant configuration.

4.2.2. ME910G1-W1 Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
CATM	180	400	1 RB, RMC, TBS=5, QPSK, 21dBm, all bands
NBIoT	245	340	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 20dBm, all bands
	65	290	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 21dBm, all bands

Table 16: ME910G1-W1 Connected Mode

4.2.3. ME910G1-WW and ME910G1-WWV Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
CATM	380	1100	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 85, 28, 12
	320	900	1 RB, RMC, TBS=5, QPSK,23dBm, Band 13, 26, 5, 18, 19, 20, 8
	305	800	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
NBIoT	240	335	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 20dBm, Band 71
	600	1000	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 85, 28, 12
	500	850	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 13, 26, 5, 18, 19, 20, 8
	430	750	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
	68	300	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 21dBm, Band 71
	88	950	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 85, 28, 12
	78	800	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 13, 26, 5, 18, 19, 20, 8
	77	730	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
GPRS	300	2000	1TX + 1RX, CS1, GMSK, Band 850, 900
	170	1000	1TX + 1RX, CS1, GMSK, Band 1800, 1900

Table 17: ME910G1-WW and ME910G1-WWV Connected Mode

4.2.4. ME910G1-W3 Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
CATM	185	390	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 12, 13, 14, 28, 85
CATM	195	415	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 5, 8, 8_39d, 18, 19, 20, 26, 27
CATM	205	450	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 1, 2, 3, 4 19, 25, 66

Table 18: ME910G1-W3 Connected Mode

4.3. General Design Rules

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

4.3.1. Electrical Design Guidelines of the Power Supply

The electrical design of the power supply depends on a drained power source.

The electrical design guidelines categories are:

- +5V input (typically PC internal regulator output)
- +12V input (typically automotive)
- Battery

4.3.1.1. +5V Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V. since the difference between the input source and the desired output is negligible, a linear regulator can be used. A switching power supply will not be suitable because of the low drop out requirements.
- If using a linear regulator, include a proper heat sink to dissipate the excess generated power.
- A low ESR Bypass capacitor must be included to stop the current absorption peaks near the Module. The recommended capacitor is 100µF .
- Make sure the low ESR capacitor on the power supply output is a minimum of 10V.

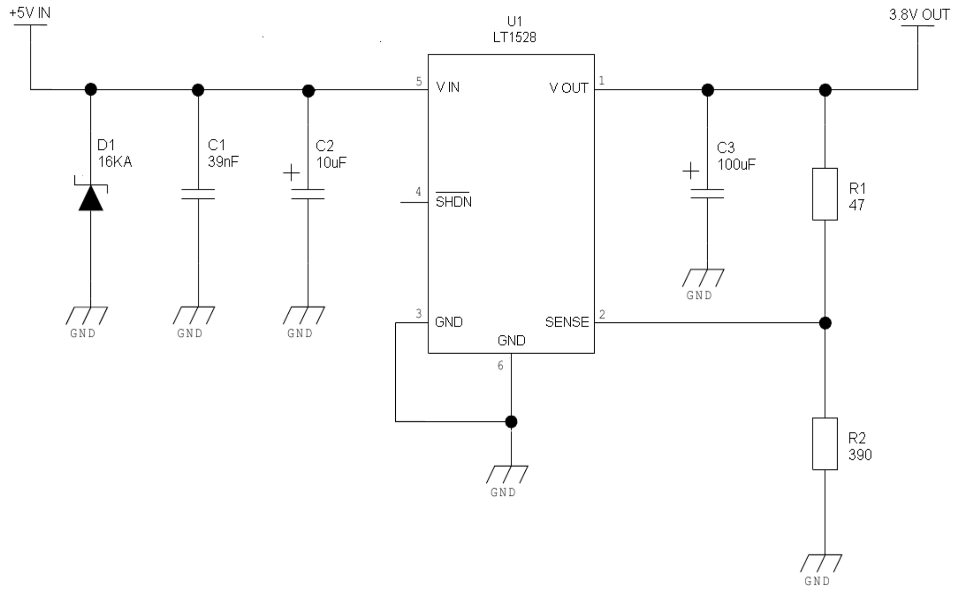


Figure 2: An example of linear regulator with 5V input

4.3.1.2. +12V Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, so due to the large difference between the input source and the desired output, a linear regulator is not suitable and shall not be used. A switching power supply will be preferable because of its better efficiency.
- A regulator must be provided to absorb current peaks. The recommended switching regulator is 500kHz or more. Due to its smaller inductor size and faster transient response, it has a higher switching frequency.
- The frequency and selection of Switching design are related to the application, since the switching frequency could also generate EMC interferences.
- For a PB car battery the input voltage may rise up to 15,8V and this must be considered when selecting components: all components in the power supply must support this voltage.
- A low ESR Bypass capacitor must be included to stop the current absorption peaks near the Module. The recommended capacitor is 100µF.
- Make sure the low ESR capacitor on the output of the power supply is rated at least 10V.
- For Car applications, a spike protection diode should be placed close to the power input, to clean the supply from the spikes.

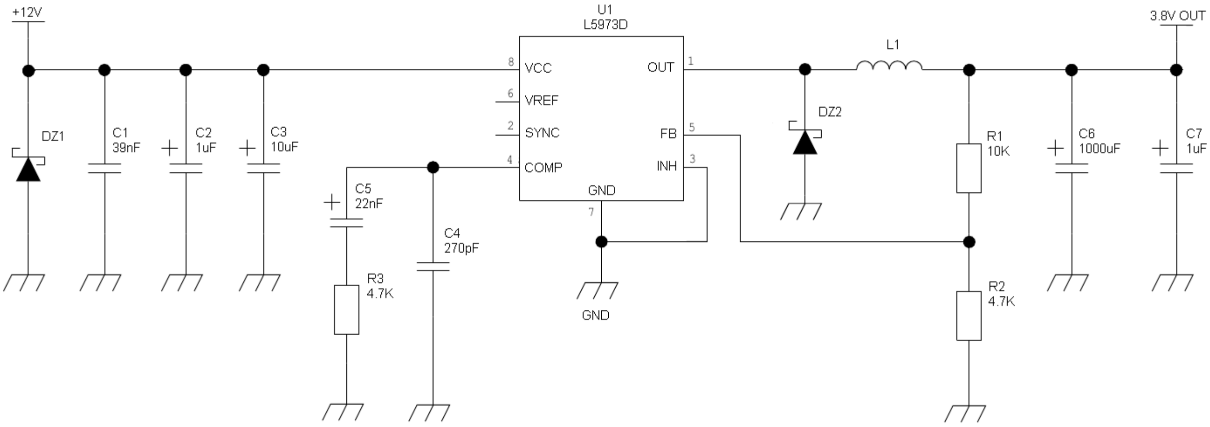


Figure 3: An example of switching regulator with 12V input

4.3.1.3. Battery Source Power Supply Design Guidelines

The nominal output of the desired power supply is 3.8V and the maximum voltage allowed is 4.2V. So a single 3.7V Li-Ion cell battery type is sufficient to power the Telit ME910G1 module.

- A low ESR Bypass capacitor of adequate capacity must be provided to stop the current absorption peaks. The recommended capacitor is a 100µF.
- Make sure the low ESR capacitor is rated at least 10V.
- A protection diode must be placed near the power input. This protects the ME910G1 from power polarity inversion. Otherwise, the battery connector must be specifically designed to avoid polarity inversions when connecting the battery.
- The battery must be rated to supply peaks of current up to 2A.

Note: DO NOT USE any Ni-Cd, Ni-MH, and Pb battery types directly connected with ME910G1. Their use can lead to overvoltage on the ME910G1 and damage it. You can use LI-Ion, Li-Po, Li-FePO4 secondary batteries or hi current Lithium primary batteries.

4.3.2. Thermal Design Guidelines

Worst case as reference values for thermal design of ME910G1 are:

- Average current consumption: 700 mA (LTE CAT M1 and NB1 modes)
- Average current consumption: 700 mA (GPRS and EDGE modes)
- Supply voltage: 4.50V

Note: Make the PCB design to have the best connection of GND pads to large copper surfaces.

Note: The ME910G1 includes a function to prevent overheating.

4.3.3. Power Supply PCB Layout Guidelines

As seen in the electrical design guidelines, the power supply shall have a low ESR capacitor on the output to cut the current peaks on the input to protect the supply from spikes. The placement of this component is essential for the correct working of the circuitry. A misplaced component can be useless or can even decrease the performance of the power supply.

- The low ESR Bypass capacitor must be placed near the Telit ME910G1 power input pads or, if the power supply is of the switching type, it can be placed near to the inductor to cut the ripple provided that the PCB trace from the capacitor to the ME910G1 is wide enough to ensure a voltage dropless connection even during a 0.6 A (LTE) or 2A (GSM) current peak.
- The protection diode must be placed close to the input connector where the power source is drained.
- The PCB's traces from the input connector to the power regulator IC must be wide enough to ensure no voltage drops occur when an 2 A current peak is absorbed (valid only for product supporting GSM mode).
- The PCB traces to the ME910G1 and the Bypass capacitor must be wide enough to ensure no significant voltage drops occur. This is for the same reason as previous point. Try to keep this trace as short as possible.
- To reduce the EMI due to switching, it is important to keep the mesh involved very small; then the input capacitor, the output diode (if not embodied into the IC) and the regulator will form a very small loop.This is done to reduce the radiated field (noise) at the switching frequency (usually 100-500 kHz).
- A dedicated ground for the Switching regulator separated from the common ground plane is suggested.
- The placement of the power supply on the board must be done in such a way as to guarantee that the high current return paths in the ground plane do not overlap

with noise sensitive circuitry such as the microphone amplifier/buffer or the earphone amplifier.

- Power supply input cables should be kept separate from noise sensitive lines such as microphone/earphone cables.
- The insertion of the EMI filter on VBATT pins is recommended in those designs where antenna is placed near batteries or supply lines. For this purpose, a Murata BLM18EG101TN1 or Taiyo Yuden P/N FBMH1608HM101 ferrite bead can be used.

The below figure shows the recommended circuit:

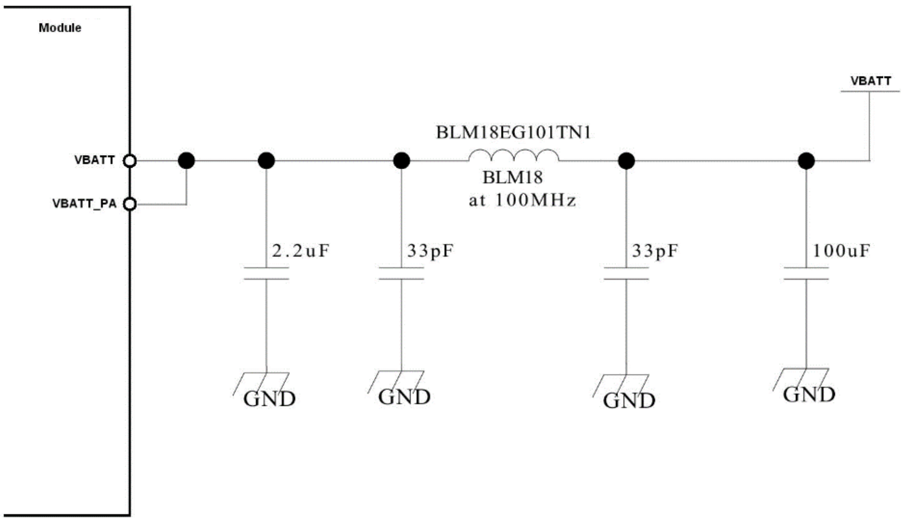


Figure 4: Recommended Circuit

4.4. VAUX Power Output

A regulated power supply output is provided to supply small devices from the module, such as: level translators, audio codec, sensors and others.

Pin R11 can also be used as PWRMON function (module powered ON indication), because it is always active when the module is powered ON and cannot be set to LOW level by any AT command. The Host can detect deep sleep mode only by monitoring the VAUX/PWRMON output pin, since there is no dedicated pin for the PSM status indicator.

The characteristics of the operating range of the supply are:

Item	Min	Typical	Max
Output voltage	1.78V	1.80V	1.82V
Output current	-	-	60mA
Output bypass capacitor (inside the module)		1uF	

Table 19: Operating range characteristics of the supply

Note: If the power saving configuration is enabled by AT+CPSMS Command, VAUX during the period of deep sleep mode is OFF

4.5. RTC Supply

RTC is functional when ME910G1 is in PSM or OFF state and VBATT pin is supplied.

RTC settings are lost if VBATT supply is temporary disconnected.

5. DIGITAL SECTION

ME910G1 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 ME910G1 is ready to accept AT commands. ME910G1 can be idle or connected.
- **Sleep mode state**: main baseband processor is intermittently switched ON and AT commands can be processed with some latency. ME910G1 is idle with low current consumption.
- **Deep sleep mode state**: PSM defined in 3GPP Release 12. Baseband is switched OFF most of the time.

5.1. Logic Levels

Parameter	Min	Max
ABSOLUTE MAXIMUM RATINGS – NOT FUNCTIONAL		
Input level on any digital pin (CMOS 1.8) with respect to ground	-0.3V	2.1V
Operating Range - Interface levels (1.8V CMOS)		
Input high level	1.5V	1.9V
Input low level	0V	0.35V
Output high level	1.6V	1.9V
Output low level	0V	0.2V

Table 20: Logic levels Minimum and maximum

Parameter	Max
Current characteristics:	
Output Current	1mA
Input Current	1uA

Table 21: Logic levels average

5.2. Power On

To turn on the ME910G1 the pad ON_OFF*/WAKE* must be tied low for at least 5 second and then released.

The maximum current that can be drained from the ON_OFF*/WAKE* pad is 0,1 mA.

The ON_OFF*/WAKE* pad can make an asynchronous wakeup of the system from PSM Mode, before the scheduled event of timer T3412 expired.

To make asynchronous exit from PSM mode ON_OFF*/WAKE* pin must be set to LOW for at least 5 seconds.

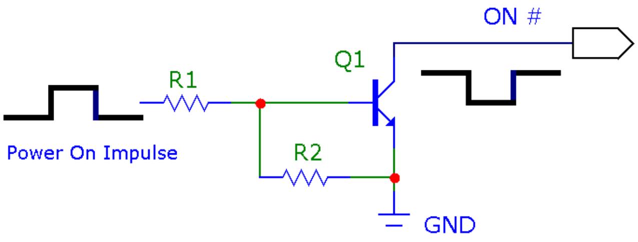


Figure 5: Power-on Circuit; illustrates a simple circuit to power on the module using an inverted buffer output.

Note: Do not use any pull up resistor on the ON_OFF*/WAKE* line, it is internally pulled up. Using pull up resistor may bring to latch up problems on the ME910G1 power regulator and improper power on/off of the module. The ON_OFF*/WAKE* line must be connected only in open collector or open drain configuration.

In this document all the lines that are inverted, so they have active low signals are labeled 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.

A flow chart showing the proper turn on procedure is displayed below:

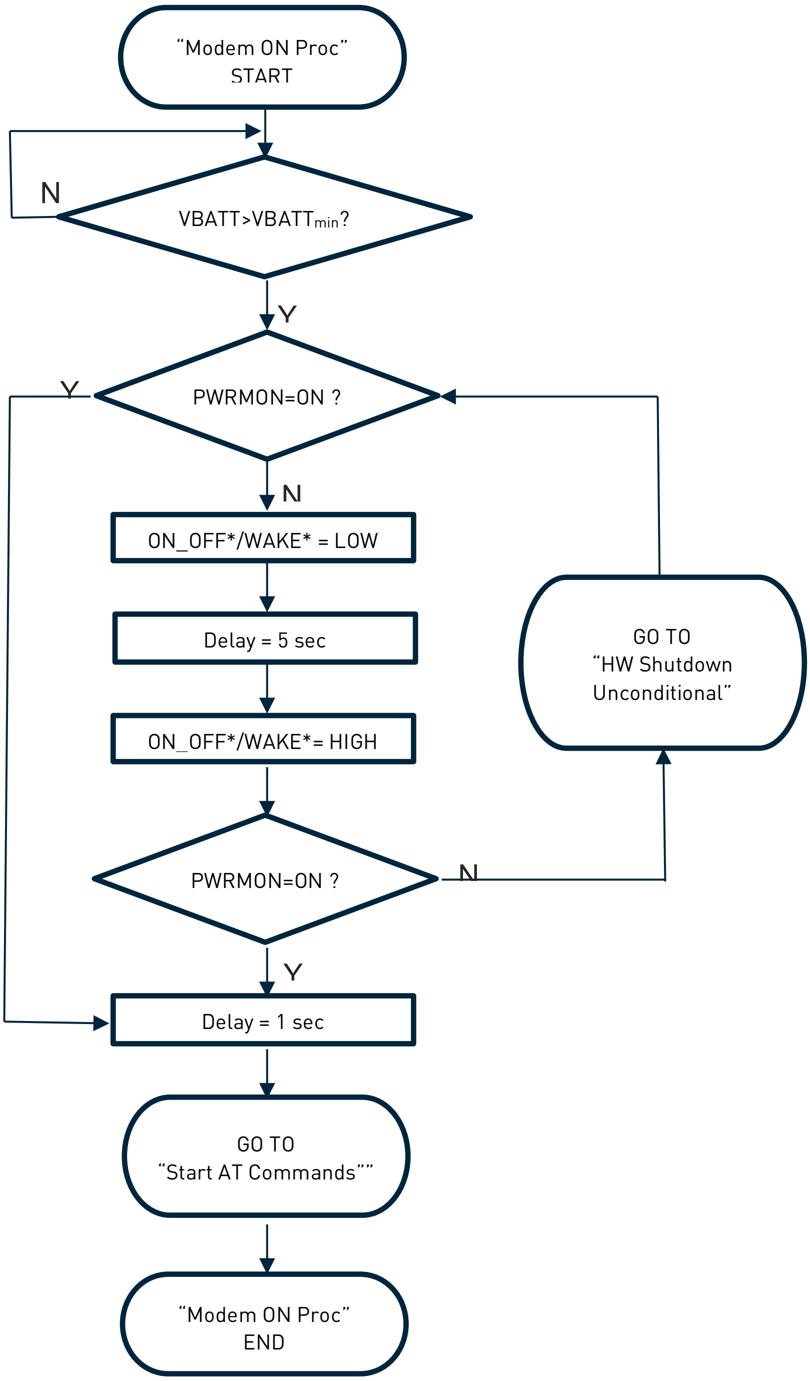


Figure 6: Turn on procedure flow chart

A flow chart showing the AT commands managing procedure is displayed below:

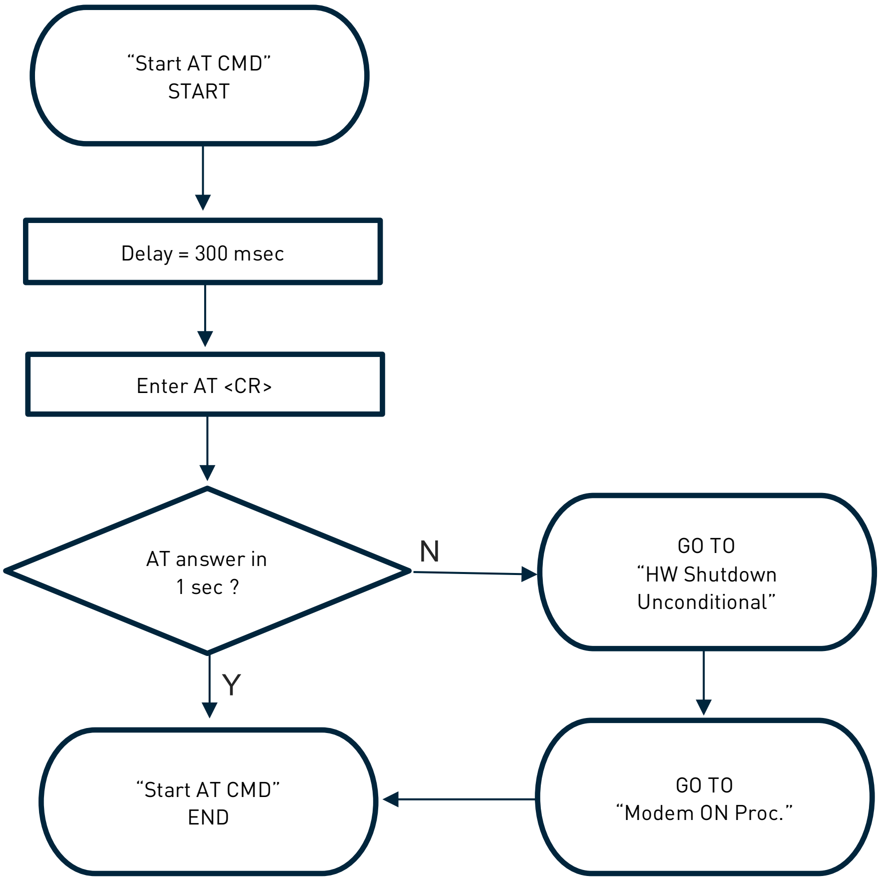
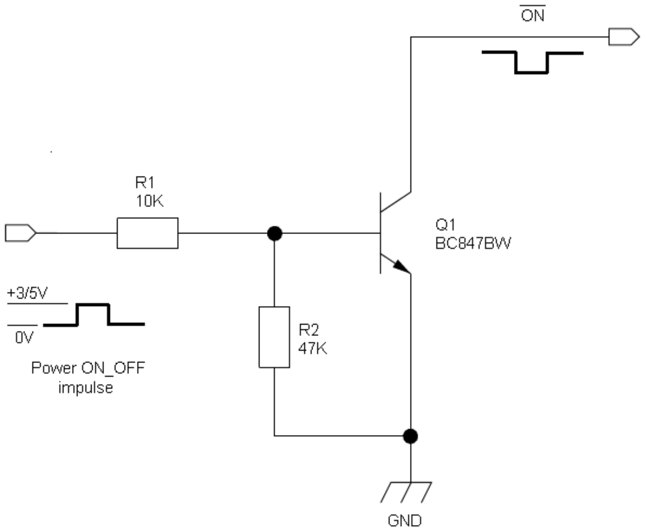


Figure 7: AT commands managing procedure flow chart

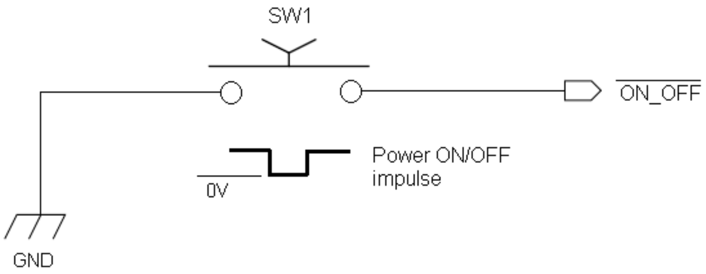
Note: To avoid a back powering it is recommended to prevent any HIGH logic level signal from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON-OFF transition.

For example:

1- Let's assume you need to drive the ON_OFF*/WAKE* pad with a totem pole output of a +3/5 V microcontroller (uP_OUT1):



2- Let's assume you need to drive the ON_OFF*/WAKE* pad directly with an ON/OFF button:



Warning: It is recommended to set the ON_OFF*/WAKE* line LOW to power on the module only after VBATT is higher than 3.20V.If this condition is not satisfied, it is possible to use the HW_SHUTDOWN* line to recover it and then restart the power on activity using the ON_OFF*/WAKE* line. An example of this is described in the following diagram.

After HW_SHUTDOWN* has been released, you can use again the ON_OFF*/WAKE* line to power on the module.

5.3. Power Off

Turning off of the device can be done in two ways:

- via AT command (see ME910G1 Software User Guide, AT#SHDN)
- pin ON_OFF*/WAKE* for at least 3 seconds

In both cases, the device sends a disconnection request to the network informing that the device will no longer be reachable.

Note: To check if the device has been powered off or IN PSM mode, the hardware line PWRMON must be monitored. The device is powered off when PWRMON goes low.

To avoid a back powering it is recommended to prevent any HIGH logic level signal from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON-OFF transition.

Warning: Failure to follow the recommended shut-down procedures might damage the device and consequently void the warranty.

The following flow chart shows the proper turn off procedure:

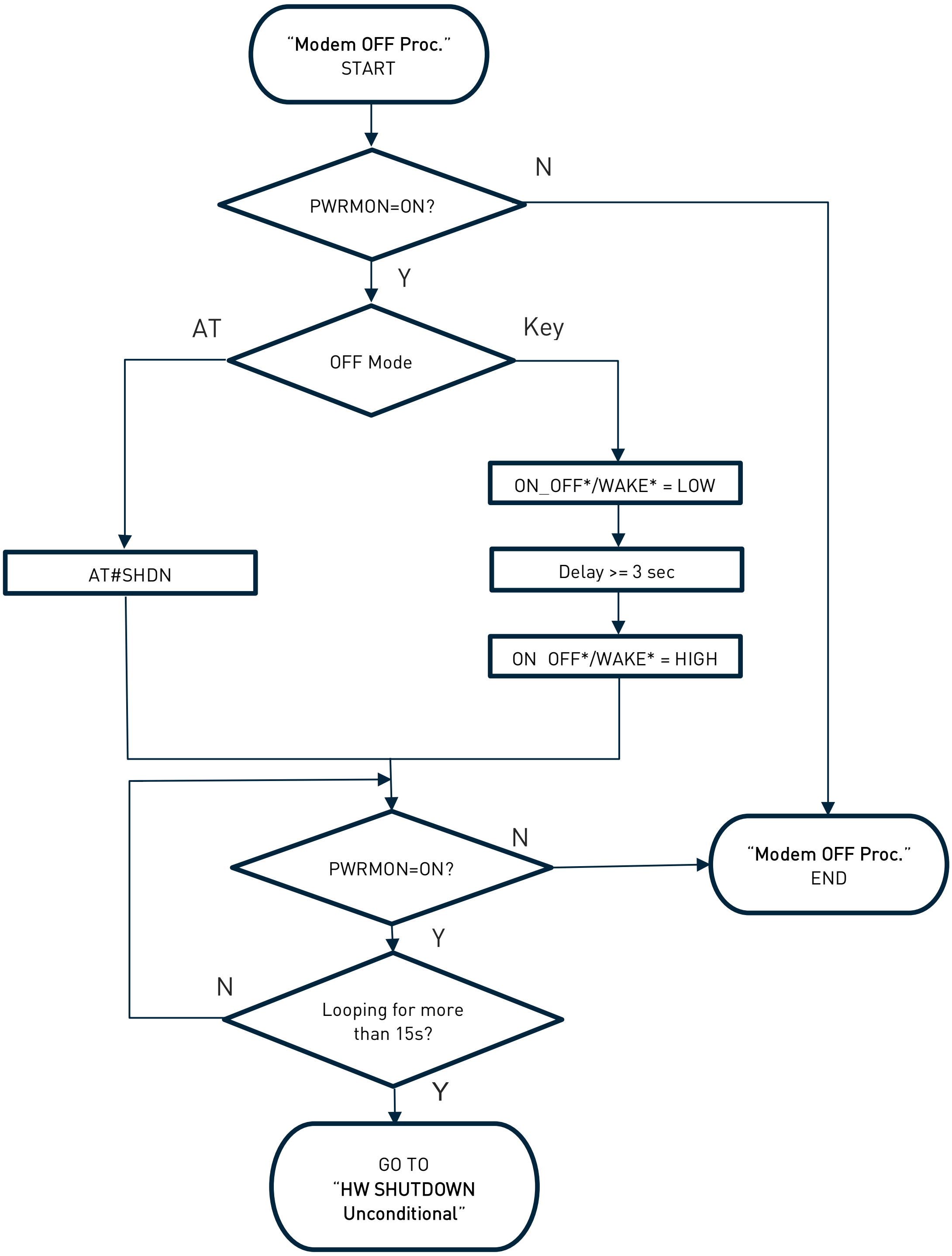


Figure 8: turn off procedure flow chart

5.4. Wake from Deep Sleep Mode

ME910G1 supports Power Saving Mode (PSM) functionality defined in 3GPP Release 12. When Periodic Update Timer expires, ME910G1 power off until the next scheduled wake-up time.

Host-controlled asynchronous event can wake up from deep sleep mode by asserting the ON_OFF*/WAKE* pin LOW for at least 5 seconds.

The Host can detect deep sleep mode by pulling VAUX/PWRMON pin if previously configured.

5.5. Unconditional Shutdown

HW_SHUTDOWN* is used to unconditionally shutdown the ME910G1. Whenever this signal is pulled low, the ME910G1 is reset. When the device is reset it stops any operation. After the release of the line, the ME910G1 is unconditionally shut down, without carrying out any disconnection from the network in which it is registered. This behaviour is not a proper shut down because any cellular device is requested to issue a disconnection request on turn off. The HW_SHUTDOWN* is internally controlled on start-up to always achieve a proper power-on reset sequence, so there's no need to control this pin on start-up.

To unconditionally shutdown the ME910G1, the pad HW_SHUTDOWN* must be tied low for at least 200 milliseconds and then released.

The signal is internally pulled up so the pin can be left floating if not used.

If used, it **must always be connected with an open collector transistor**, to allow the internal circuitry the power on reset and under voltage lockout functions.

During PSM mode, the HW_SHUTDOWN toggle has no effect. The use of the HW_SHUTDOWN* pin is valid only when the ME910G1 has VAUX/PWRMON output HI.

PIN DESCRIPTION

Signal	Function	I/O	PAD
HW_SHUTDOWN*	Unconditional Shutdown of the Module	I	R13

Table 22: HW_SHUTDOWN signal*

Warning: The unconditional hardware Shutdown must not be used during the normal operation of the device since it does not disconnect the device from the network. It shall be kept as an emergency exit procedure.

A typical circuit is the following:

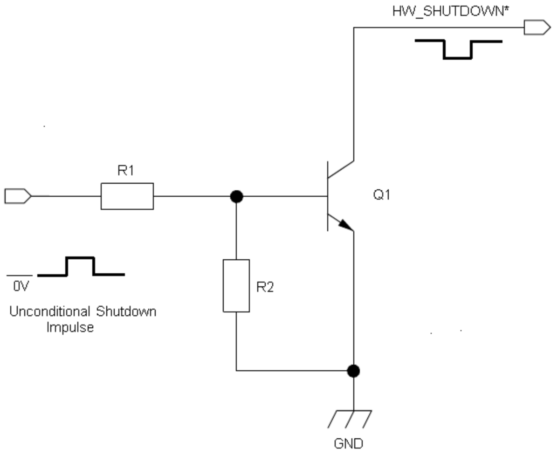


Figure 9: typical circuit

For example: Let us assume you need to drive the HW_SHUTDOWN* pad with a totem pole output of a +3/5 V microcontroller (uP_OUT2):

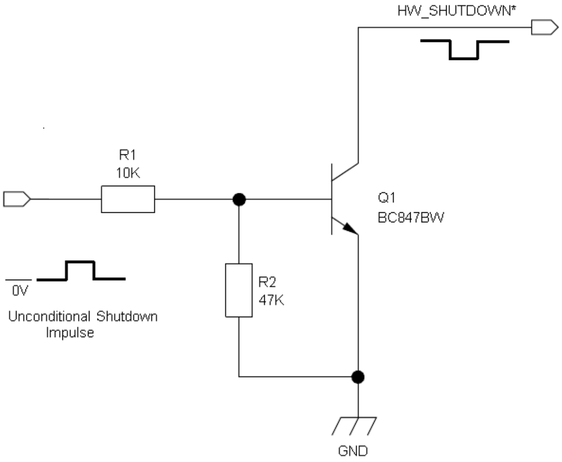


Figure 10: typical circuit

In the following flow chart the proper restart procedure is detailed:

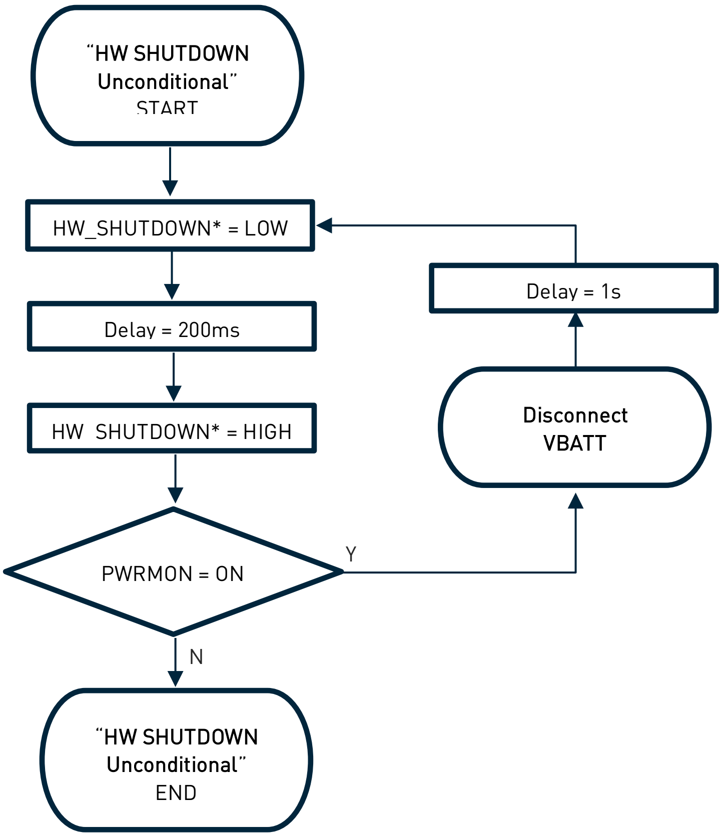


Figure 11: restart procedure flow chart

Note: In order to avoid a back powering it is recommended to prevent any HIGH logic level signal from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON-OFF transition.

Note: Do not use any pull up resistor on the HW_SHUTDOWN* line nor any totem pole digital output. Using pull up resistor may bring to latch up problems on the ME910G1 power regulator and improper functioning of the module.

To proper power on again the module please refer to the related paragraph ("Power ON")

The unconditional hardware shutdown must always be implemented on the boards and should be used only as an emergency exit procedure.

5.6. Fast Shut Down

The procedure to power off ME910G1 described in the Power Off section. It normally takes more than 1 second to disconnect from the network and make ME910G1 internal filesystem properly closed.

In case of unwanted supply voltage loss the system can be switched off without any risk of filesystem data corruption by implementing the Fast Shut Down feature.

Fast Shut Down feature permits to reduce the current consumption and the time-to-poweroff to minimum values.

Note: Refer to ME910G1 series AT command reference guide (Fast shut down - #FASTSHDN) in order to set up detailed AT command.

5.6.1. Fast Shut Down by Hardware

The fast shut down can be triggered by the configuration of any GPIO. Switching from HI level to LOW level transition of GPIO commands fast shut down.

Example circuit:

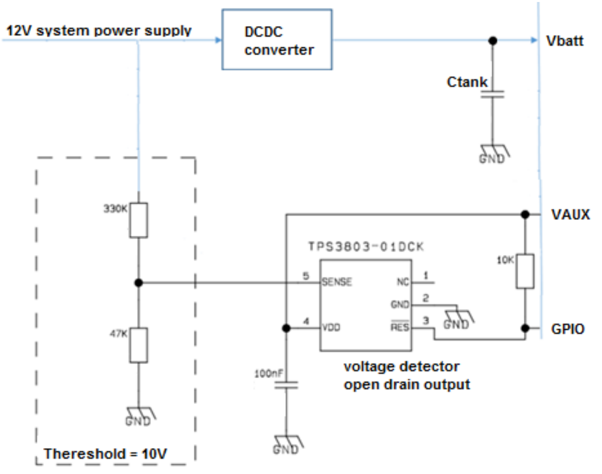


Figure 12: example circuit

Note: Consider the voltage drop under max current conditions when defining the voltage detector thereshold in order to avoid unwanted shutdown.

The capacitor is rated with the following formula:

$$C = I \frac{\Delta t}{\Delta V}$$

Tip: Make the same plot during system verification to check timings and voltage levels.

5.6.2. Fast Shut Down by Software

The fast shut down can be triggered by AT command.

5.7. Communication Ports

Note: It is recommended to add PCB test points to UART, UART_AUX and USB of unused modules (for products supporting USB), it may be useful to reflash, test and debug the application. Test points for UART or USB are fine, however it is recommend to place the pads for a suitable connector on the port, for convenient access for network certification testing and access during early development testing. The USB connector can be "DNP" as long as it is not needed. This may be more convenient than just test points alone.

5.7.1. USB 2.0 HS

The ME910G1 includes one integrated universal serial bus (USB 2.0 HS) transceiver.

The following table lists the available signals:

PAD	Signal	I/O	Function	NOTE
B15	USB_D+	I/O	USB differential Data (+)	
C15	USB_D-	I/O	USB differential Data (-)	
A13	VUSB	AI	Power sense for the internal USB transceiver.	Accepted range: 3.0V to 5.5V 100K pull down

Table 23: Available Signals

The USB_DPLUS and USB_DMINUS signals have a clock rate of 480 MHz, so the signal traces should be carefully routed. Trace lengths, number of vias and capacitive loading should be minimized. The characteristic impedance value should be as close as possible to 90 Ohms differential.

ESD protection can be added to USB D+/D- lines in case of external connector for cable connection. Proper components for USB 2.0 must be used.

5.7.2. SPI

The ME910G1 Module is provided by a standard 3-wire master SPI interface + chip select control.

The following table lists the available signals:

PAD	Signal	I/O	Function	Type	NOTE
D15	SPI_MOSI	O	SPI MOSI	CMOS 1.8V	Shared with TX_AUX
E15	SPI_MISO	I	SPI MISO	CMOS 1.8V	Shared with RX_AUX
F15	SPI_CLK	O	SPI Clock	CMOS 1.8V	
H14	SPI_CS	O	SPI Chip Select	CMOS 1.8V	

Table 24: Available Signals

Note: Due to the shared functions, SPI port and TX_AUX/RX_AUX port cannot be used simultanously.

Refer to ME910G1 series AT command reference guide for port configuration.

5.7.2.1. SPI Connections

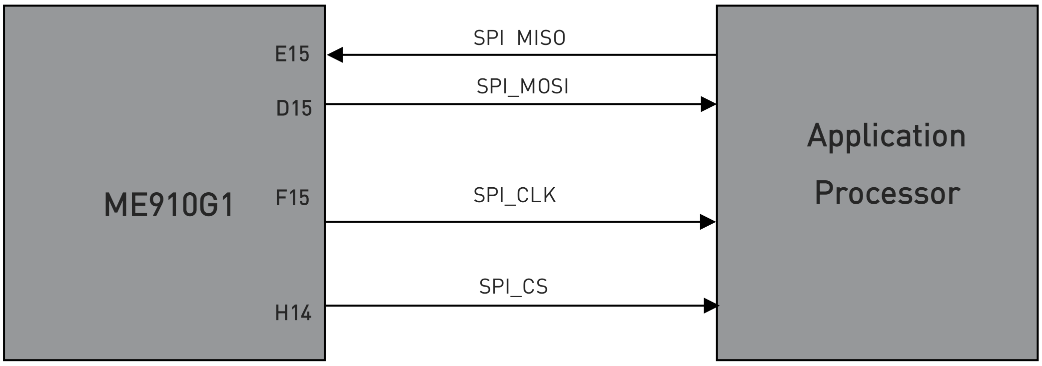


Figure 13: SPI Connections

5.7.3. Serial Ports

The ME910G1 module is provided with by 2 Asynchronous serial ports:

- MODEM SERIAL PORT 1 (Main)
- MODEM SERIAL PORT 2 (Auxiliary)

Several configurations can be designed for the serial port on the 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 type of serial port on the OEM hardware a level translator circuit may be needed to operate the system. The ports on the ME910G1 the port are CMOS 1.8.

5.7.3.1. Modem Serial Port 1 (USIF0)

The serial port 1 on the ME910G1 is a +1.8V UART with all the 7 RS232 signals. It differs from the PC-RS232 in the signal polarity (RS232 is reversed) and levels.

The following table lists the available signals:

RS232 Pin	Signal	PAD	Name	Usage
1	C109/DCD	N14	Data Carrier Detect	Output from the ME910G1 that indicates the carrier presence
2	C104/RXD	M15	Transmit line *see Note	Output transmit line of ME910G1 UART
3	C103/TXD	N15	Receive line *see Note	Input receive of the ME910G1 UART
4	C108/DTR	M14	Data Terminal Ready	Input to the ME910G1 that controls the DTE READY condition
6	C107/DSR	P14	Data Set Ready	Output from the ME910G1 that indicates the module is ready
7	C105/RTS	L14	Request to Send	Input to the ME910G1 that controls the Hardware flow control
8	C106/CTS	P15	Clear to Send	Output from the ME910G1 that controls the Hardware flow control
9	C125/RING	R14	Ring Indicator	Output from the ME910G1 that indicates the incoming call condition

Table 25: Available Signals

Note: According to V.24, some signal names refer to the application side, so on the ME910G1 side these signal are in the opposite direction:

TXD on the application side is connected to the receiving line (here named C103/TXD)

RXD on the application side will be connected to the transmit line (here named C104/RXD).

For reduced implementation, only the TXD, RXD lines can be connected, the other lines can be left open.

To avoid a back powering it is recommended to prevent any HIGH logic level signals from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON/OFF transition.

5.7.3.2. Modem Serial Port 2 (USIF1)

The auxiliary serial port on the ME910G1 is a CMOS1.8V with only the RX and TX signals.

The signals of the ME910G1 serial port are:

PAD	Signal	I/O	Function	Type	NOTE
D15	TX_AUX	O	Auxiliary UART (TX Data to DTE)	CMOS 1.8V	Shared with SPI_MOSI
E15	RX_AUX	I	Auxiliary UART (RX Data from DTE)	CMOS 1.8V	Shared with SPI_MISO

Table 26: ME910G1 serial port signals

Note: Due to the shared functions, TX_AUX/RX_AUX port and SPI port cannot be used simultanously.

In order to avoid a back powering it is recommended to prevent any HIGH logic level signal from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON/OFF transition.

Refer to ME910G1 series AT command reference guide for port configuration.

5.7.3.3. RS232 Level Translation

To interface the ME910G1 with a PC com port or an RS232 (EIA/TIA-232) application, a level translator is required. This level translator must:

- invert the electrical signal in both directions;
- change the level from 0/1.8V to +15/-15V.

Actually, the RS232 UART 16450, 16550, 16650 & 16750 chipsets accept signals with lower levels on the RS232 side (EIA/TIA-562), allowing for a lower voltage-multiplying ratio on the level translator. Note that the negative signal voltage must be less than 0V and therefore some sort of level translation is always required.

The easiest way to translate levels and invert the signal is to use a single chip level translator. There are a multitude of them, which differ in the number of drivers and receivers and in the levels (be sure to get a true RS232 level translator not a RS485 or other standards). By convention the driver is the level translator from the 0-1.8V UART to the RS232 level. The receiver is the translator from the RS232 level to 0-1.8V UART.

In order to translate the whole set of control lines of the UART you will need:

- 5 drivers
- 3 receivers

An example of RS232 level adaptation circuitry could be done using a MAXIM transceiver (MAX218)

In this case the chipset is capable to translate directly from 1.8V to the RS232 levels (Example done on 4 signals only).

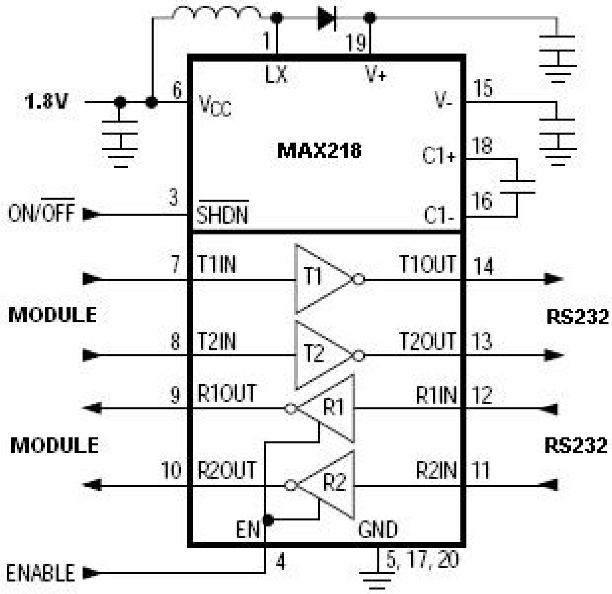


Figure 14: example circuitry

The RS232 serial port lines are usually connected to a DB9 connector with the following layout:

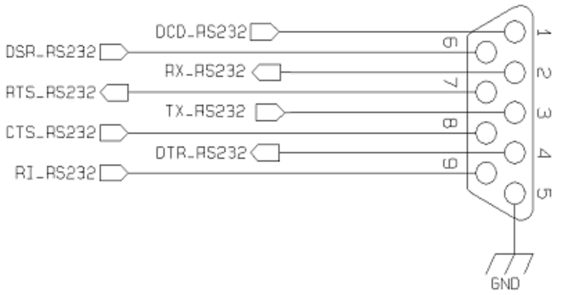


Figure 15: example RS232 serial port lines

5.8. General Purpose I/O

The ME910G1 module includes a set of Configurable Digital Input / Output pins (CMOS 1.8V). The Input pads can only be read; they report the digital value (high or low) present on the pad at the time of reading. The Output pads can only be written or queried and set the value of the pad output.

An alternate function pad is controlled internally by the ME910G1 firmware and acts depending on the function implemented.

The following table shows the available GPIO on the ME910G1:

PAD	Signal	I/O	Output Drive Strength	Default State	NOTE
C8	GPIO_01	I/O	1mA	INPUT – PD (100K)	Alternate function STAT LED
C9	GPIO_02	I/O	1mA	INPUT – PD (100K)	
C10	GPIO_03	I/O	1mA	INPUT – PD (100K)	
C11	GPIO_04	I/O	1mA	INPUT – PD (100K)	
B14	GPIO_05	I/O	1mA	INPUT – PD (100K)	
C12	GPIO_06	I/O	1mA	INPUT – PD (100K)	
C13	GPIO_07	I/O	1mA	INPUT – PD (100K)	
K15	GPIO_08	I/O	1mA	INPUT – PD (100K)	
L15	GPIO_09	I/O	1mA	INPUT – PD (100K)	
G15	GPIO_10	I/O	1mA	INPUT – PD (100K)	

Table 27: ME910G1 available GPIO

5.8.1. Using a GPIO as INPUT

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

If the digital output of the device to be connected with the GPIO input pad of ME910G1 has interface levels other than the 1.8V CMOS, then it can be buffered with an open collector transistor with a 47K pull up to 1.8V supplied by VAUX/POWERMON R11 pad.

Note: To avoid a back powering, it is recommended to prevent any HIGH logic level signal from being applied to the digital pins of the ME910G1 when the module is powered off or during an ON/OFF transition. Refer to ME910G1 series AT command reference guide for GPIO pins configuration.

5.8.2. Using a GPIO as OUTPUT

GPIO pads, when used as outputs, can drive 1.8V CMOS 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.

5.8.3. Indication of Network Service Availability

The STAT_LED pin status shows information on the network service availability and Call status. The function is available as an alternate function of GPIO_01 (to be enabled using the AT#GPIO=1,0,2 command). In the ME910G1 modules, the STAT_LED needs an external transistor to drive an external

LED and its voltage level is defined according to the table below:

Device Status	Led Status
Device off	Permanently off
Not Registered	Permanently on
Registered in idle	Blinking 1sec on + 2 sec off
Registered in idle + power saving	It depends on the event that triggers the wakeup (In sync with network paging)
Connecting	Blinking 1 sec on + 2 sec off

Table 28: LED and its status

In the following reference schematic for LED indicator, R3 must be calculated taking in account VBATT value and LED type:

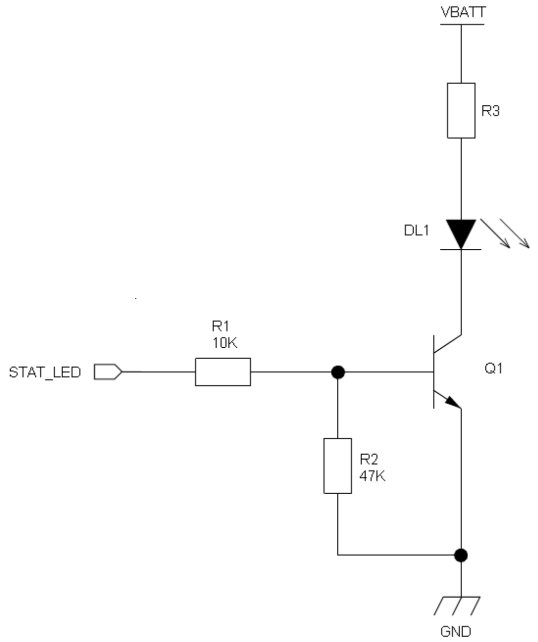


Figure 16: LED indicator reference schematic

5.9. External SIM Holder

Please refer to the related User Guide (SIM Holder Design Guides, 80000NT10001a).

5.10. ADC Converter

The ME910G1 is includes one AD converter. It can read a voltage level in the range of 0÷1.8 volts applied on the ADC pin input, store it and convert it into 10 bit word.

The input line is named as **ADC_IN1** and it is available on Pad **B1**

The following table is showing the ADC characteristics:

Item	Min	Typical	Max	Unit
Input Voltage range	0	-	1.8	Volt
AD conversion	-	-	10	bits
Input Resistance	1	-	-	Mohm
Input Capacitance	-	1	-	pF

Table 29: ADC characteristics

The ADC could be controlled using an AT command.

The command is ***AT#ADC=1,2***

The read value is expressed in mV

Refer to SW User Guide or AT Commands Reference Guide for the full description of this function.

5.11. Forced USB Boot

If standard firmware upgrade procedures are not possible, the FORCED_USB_BOOT pin must be set to 1.8V when power-on of the module.

The input current is very low so 10K resistor can be used to keep this pin in HI state.

FORCED_USB_BOOT pin must be connected only during the firmware upgrade operation. It must be left open during normal operation.

FORCED_USB_BOOT pin must be available in the user application circuit through test point for easy connection to external 1.8V supply.

5.12. Antenna Tuner

The ME910G1 includes a feature to enable an external antenna tuning solution. This enables to dynamically tune the antenna on multiple frequencies.

Refer to AT command AT#ATUNERSEL (AT Commands Reference Guide-Telit code 80617ST10991A) to select GPIO or MIPI interfaces on ATC1/ATC2 pins.

5.12.1. GPIO

ATC1 Pin	ATC2 Pin	Band (Uplink)	Freq. Range [MHz]
0	0	B1, B2, B3, B4, B25, B66, GSM1800, GSM1900	1710-2200
0	1	B8, EGSM900	880-960
1	0	B5, B18, B19, B20, B26, B27 GSM850	791-894
1	1	B12, B13, B28, B85	698-803

Table 30 Antenna Tuner GPIO table

5.12.2. MIPI

The MIPI interface is intended to be used in bundle with Qualcomm QAT3516 Adaptive Aperture Tuner.

6. RF SECTION

6.1. Antenna Requirements

The antenna connection and the board layout design are the most important aspect of the complete product design. It strongly affects the general performance of the product, so read carefully and follow the requirements and the guidelines for a proper design.

The antenna and antenna transmission line on PCB for a Telit ME910G1 device shall fulfil the following requirements:

Item	Value
Frequency range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
Bandwidth	250 MHz in LTE Band 1 140 MHz in LTE Band 2, PCS1900 170 MHz in LTE Band 3, DCS1800 445 MHz in LTE Band 4 70 MHz in LTE Band 5, GSM850 80 MHz in LTE Band 8, GSM900 47 MHz in LTE Band 12 41 MHz in LTE Band 13 60 MHz in LTE Band 18 60 MHz in LTE Band 19 71 MHz in LTE Band 20 145 MHz in LTE Band 25 80 MHz in LTE Band 26 62 MHz in LTE Band 27 100 MHz in LTE Band 28 490 MHz in LTE Band 66 81 MHz in LTE Band 71 48 MHz in LTE Band 85
Impedance	50 ohm
Input power	ME910G1-W1: > 24dBm Average power ME910G1-WW: > 33dBm Average power
VSWR absolute max	≤ 10:1 (limit to avoid permanent damage)
VSWR recommended	≤ 2:1 (limit to fulfill all regulatory requirements)

Table 31: ME910G1 Antenna and Antenna transmission line on PCB

6.1.1. PCB Design Guidelines

When using the ME910G1, as there is no antenna connector on the module, the antenna must be connected to the ME910G1 antenna pad (K1) by means of a transmission line implemented on the PCB.

This transmission line shall fulfil the following requirements:

Item	Value
Characteristic Impedance	50 ohm (+-10%)
Max Attenuation	0,3 dB
Coupling	Coupling with other signals shall be avoided
Ground Plane	Cold End (Ground Plane) of antenna shall be equipotential to the ME910G1 ground pins

Table 32: ME910G1 Antenna pad requirements

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

- Make sure that the characteristic impedance of the transmission line is 50 ohm;
- Keep the line on the PCB as short as possible, as the loss of the antenna line should be less than about 0,3 dB;
- The line geometry should have uniform characteristics, constant cross section, avoid meanders and sharp curves;
- Any type of suitable geometry / structure (Microstrip, Stripline, Coplanar, Grounded Coplanar Waveguide...) can be used to implement the printed transmission line afferent to the antenna;
- If a Ground plane is required in line geometry, that plane shall be continuous and sufficiently extended, so that the geometry can be as similar as possible to the related canonical model;
- Keep, if possible, at least one layer of the PCB used only for the Ground plane; If possible, use this layer as a reference Ground plane for the transmission line;
- It is advisable to surround (on both sides) the transmission line of the PCB with Ground, avoiding that other signal tracks face directly the antenna line track.
- Avoid crossing any un-shielded transmission line footprint with other signal tracks on different layers;

  The ground surrounding the antenna line on PCB shall be strictly connected to the main Ground Plane by means of via holes (once per 2mm at least), positioned near the ground edges facing the line track;

- Place the noisy EM devices as far as possible away from the ME910G1 antenna line;
- Keep the antenna line far away from the ME910G1 power supply lines;
- If there are noisy EM devices (such as fast switching ICs, LCD and so on) on the PCB hosting the ME910, shield the antenna line by burying it in an inner layer of the PCB and surrounding it with the Ground planes, or shield it with a metal frame cover.
- If noisy EM devices are not present around the line, it is preferable to use geometries such as Microstrip or Grounded Coplanar Waveguide, as they typically ensure less attenuation than a Stripline of the same length.

The following image is showing the suggested layout for the Antenna pad connection:

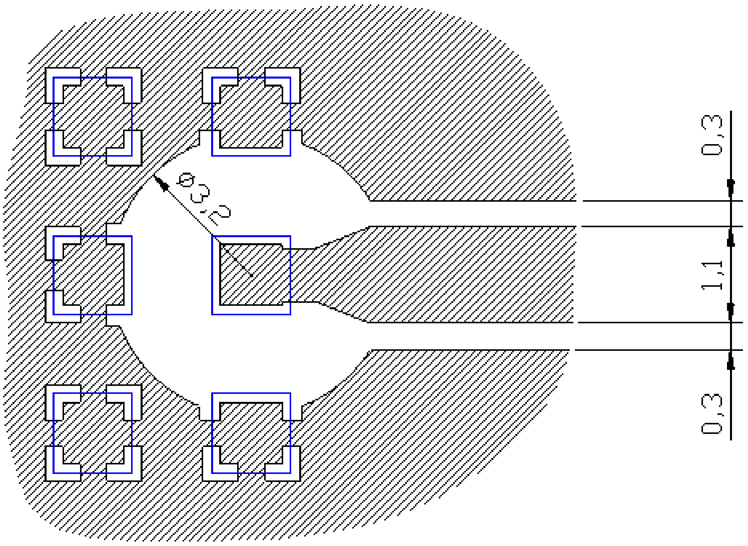


Figure 17: Layout for the Antenna pad connection

6.1.2. PCB Guidelines in Case of FCC Certification

In case FCC certification is required for an application using ME910G1, according to FCC KDB 996369 for modular approval requirements, the transmission line must be similar to the one implemented on the ME910G1 interface board and described in the following chapter.

6.1.2.1. Transmission Line Design

When designing the ME910G1 interface board, the placement of components was chosen properly, in order to keep the line length as short as possible, thus leading to the lowest possible power losses. A Grounded Coplanar Waveguide (G-CPW) line was chosen, since this kind of transmission line ensures good impedance control and can be implemented in an outer PCB layer as needed in this case. A SMA female connector has been used to feed the line.

The interface board is made on a FR4, 4-layers PCB. The substrate material is characterized by relative permittivity εr = 4.6 ± 0.4 @ 1 GHz, TanD= 0.019 ÷ 0.026 @ 1 GHz.

A characteristic impedance of nearly 50 Ω is obtained using the trace width = 1.1 mm, clearance from a coplanar ground plane = 0.3 mm each side. The line uses the reference ground plane on layer 3, while copper is removed from layer 2 below the line. The height of the trace from the ground floor is 1.335 mm. The calculated characteristic impedance is 51.6 Ω, the estimated line loss is less than 0.1 dB.

The line geometry is shown below:

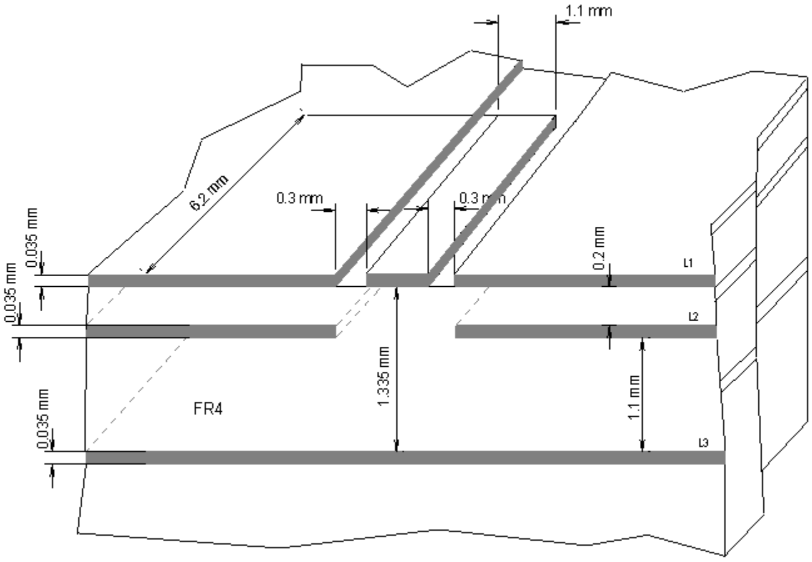


Figure 18: Line geometry

6.1.2.2. Transmission Line Measurements

An HP8753E VNA (Full-2-port calibration) was used in this measurement session.

A calibrated coaxial cable was soldered to the pad corresponding to RF output; a SMA connector was soldered to the board in order to characterize the losses of the transmission line including the connector itself. During Return Loss / impedance measurements, the transmission line has been terminated to 50 Ω load.

Return Loss plot of line under test is shown below:

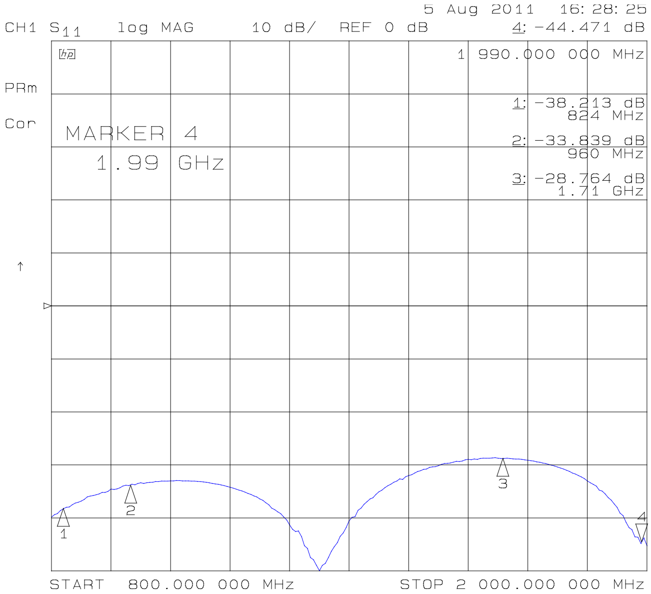


Figure 19: Return Loss plot of line under test

Line input impedance (in Smith Chart format, once the line has been terminated to 50 Ω load) is shown in the following figure:

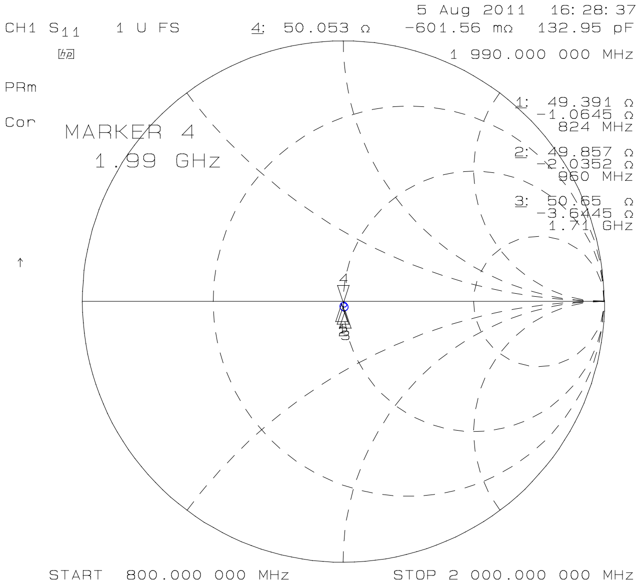


Figure 20: Line input impedance

Insertion Loss of G-CPW line plus SMA connector is shown below:

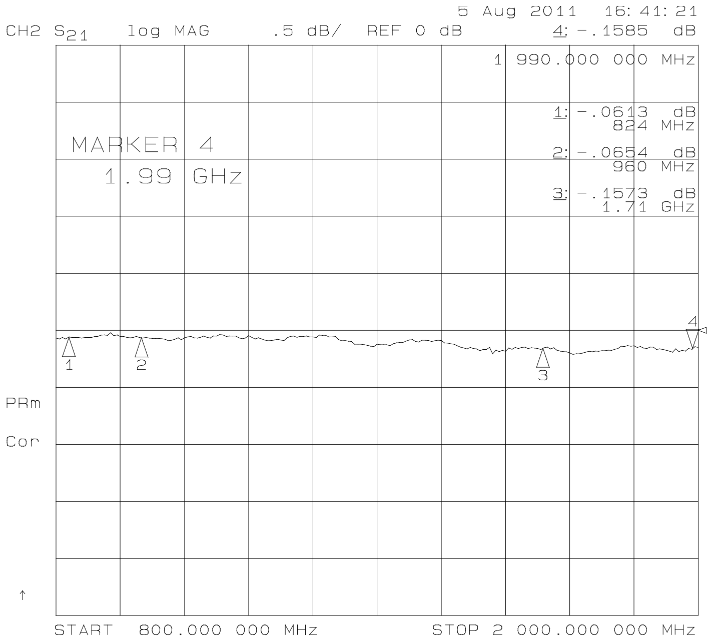


Figure 21: Insertion Loss of G-CPW line plus SMA connector

6.1.2.3. Antenna Installation Guidelines

- Install the antenna in a place covered by the LTE signal with CAT-M1 support.
- The Antenna must not be installed inside metal cases.
- The Antenna must be installed according Antenna manufacturer instructions.
- The Antenna integration should optimize the Radiation Efficiency. Efficiency values > 50% are recommended on all frequency bands.
- The Antenna integration should not perturb the radiation pattern described in the documentation of the Antenna manufacturer.
- It is preferable to obtain an omnidirectional radiation pattern.
- The Antenna Gain must not exceed the values indicated in regulatory requirements, where applicable, in order to meet related EIRP limitations. Typical antenna Gain in most M2M applications does not exceed 2dBi.
- If the device antenna is located farther than 20cm from the human body and there are no co-located transmitter, the Telit FCC/IC approvals can be re-used by the end product.
- If the device antenna is located closer than 20cm from the human body or there are co-located transmitter , the additional FCC/IC testing may be required for the end product (Telit FCC/IC approvals cannot be reused).

7. AUDIO SECTION

The Telit digital audio interface (DVI) of the ME910G1 Module is based on the I2S serial bus interface standard. The audio port can be connected to the end device using digital interface, or via one of the several compliant codecs (in case an analog audio is needed).

7.1. Electrical Characteristics

The product is providing the DVI on the following pins:

Pin	Signal	I/O	Function	Internal Pull Up	Type
B9	DVI_WA0	I/O	Digital Audio Interface (Word Alignment / LRCLK)		CMOS 1.8V
B6	DVI_RX	I	Digital Audio Interface (RX)		CMOS 1.8V
B7	DVI_TX	O	Digital Audio Interface (TX)		CMOS 1.8V
B8	DVI_CLK	I/O	Digital Audio Interface (BCLK)		CMOS 1.8V

Table 33: Pins DVI

8. GNSS SECTION

The ME910G1 module includes a state-of-art receiver that can simultaneously search and track satellite signals from multiple satellite constellations. This multi-GNSS receiver uses the entire spectrum of GNSS systems available: GPS, GLONASS, BeiDou, Galileo, and QZSS.

8.1. GNSS Signals Pin-out

Pin	Signal	I/O	Function	Type
R9	ANT_GNSS	I	GNSS Antenna (50 ohm)	
R7	GNSS_LNA_EN	O	GNSS External LNA Enable	CMOS 1.8V

Table 34: GNSS Signals Pin-out

Warning: GNSS_1PPS is not currently supported by software and it will be implemented in future SW releases.

8.2. RF Front End Design

The ME910G1 Module contains a pre-select SAW filter but does not contain the LNA necessary to achieve the maximum sensitivity. Active antenna (antenna with a built-in low noise amplifier) must be used and must be supplied with a proper bias-tee circuit.

8.2.1. Guidelines of PCB Line for GNSS Antenna

- Make sure that the antenna line impedance is 50ohm.
- Keep the antenna line on the PCB as short as possible to reduce the loss.
- The Antenna line must have uniform characteristics, constant cross section, avoid meanders and sharp curves.
- If possible, keep one layer of the PCB used only for the Ground plane.
- Surround (on both the sides, above and below) the antenna line on the PCB with Ground, make sure the other signal tracks do not face directly the antenna line of track.
- The ground around the antenna line on PCB must be strictly connected to the Ground Plane by placing vias once per 2mm at least.
- Place EM noisy devices as far as possible away from antenna line.

- Keep the antenna line far away from power supply lines.
- Keep the antenna line far away from GSM RF lines.
- If there are noisy EM devices around the PCB hosting the module, such as fast switching ICs, take care of the antenna line shielding by burying it inside the PCB layers and surround it with Ground planes, or shield it with a metal frame cover.
- If there are not noisy EM devices around the PCB hosting the module, use a strip-line on the superficial copper layer for the antenna line. The line attenuation will be lower than a buried one.

8.2.2. Hardware-based Solution for GNSS and LTE Coexistence

When a stand-alone GNSS receiver is present in the user application, the LTE transmission may desensitize the GNSS receiver, in particular if the decoupling between the LTE and GNSS antennas is low. A SAW filter can be added on LTE side, to protect the GNSS receiver from LTE out-of-band emissions, as described in the schematic below.

When using the GNSS receiver embedded in the ME910G1 module, there is no degradation condition, as the LTE part and the GNSS part are never active at the same time, so there is no need for filtering on the LTE side.

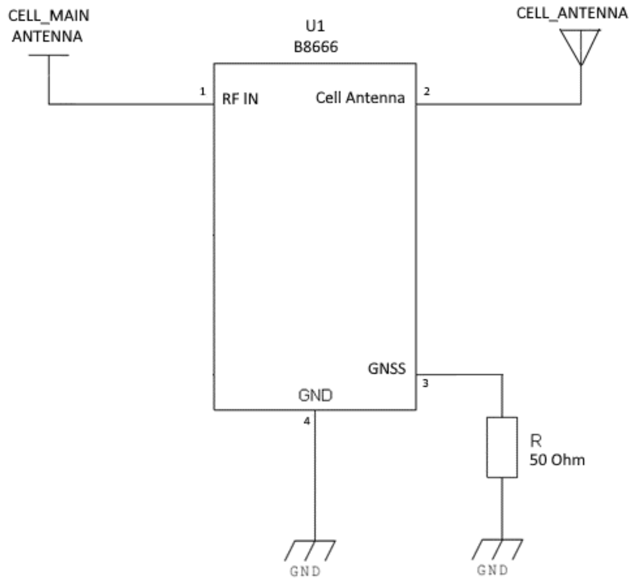


Figure 22: Reference schematic

8.3. GNSS Antenna Requirements

GNSS active antenna must be used or integrated in the application.

8.3.1. GNSS Antenna Specification

Item	Value
Frequency range	1559.0 ~ 1610.0 MHz
Gain	15 ~ 30dB
Impedance	50 ohm
Noise Figure of LNA	< 1.5 (recommended)
DC supply voltage	DC 1.8 ~ 3.3V
VSWR	≤ 3:1 (recommended)

Table 35: GNSS Antenna specification

Note: In the case of a GNSS antenna placed near the module, a gain of 15dB is sufficient, in the case of long cable the gain must be increased up to 30dB.

8.3.2. GNSS Antenna – Installation Guidelines

- The antenna must be installed according to the antenna manufacturer's instructions for maximum performance of the GNSS receiver.
- The position of the antenna must be carefully evaluated when operating in conjunction with any other antenna or transmitter.
- The antenna must not be installed inside metal cases or near any obstacle that may degrade features such as antenna lobes and gain.

8.3.3. Powering the External LNA (Active Antenna)

The active antenna LNA needs a power source because the 1.8V or 3V DC voltage required by the active antenna is not provided by the ME910G1 module, but it can easily be included by the host design.

The electrical characteristics of the GPS_LNA_EN signal are:

Level	Min	Max
Output High Level	1.6V	1.9V
Output Low Level	0V	0.3V

Table 36: Electrical characteristics of the GPS_LNA_EN

Example of external antenna bias circuitry:

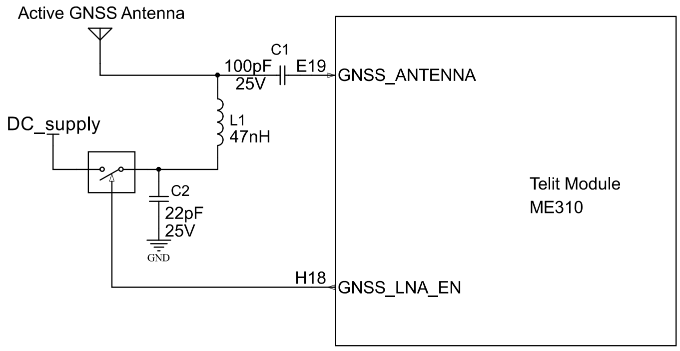


Figure 23: External antenna bias circuitry example

Pay attention to the maximum bias current in case of an unwanted short circuit on the antenna cable, as the decoupling inductor could be damaged. In case of LNA with 1.8V supply, the VAUX/POWERMON pin can be used to supply the active GNSS antenna

8.4. GNSS Characteristics

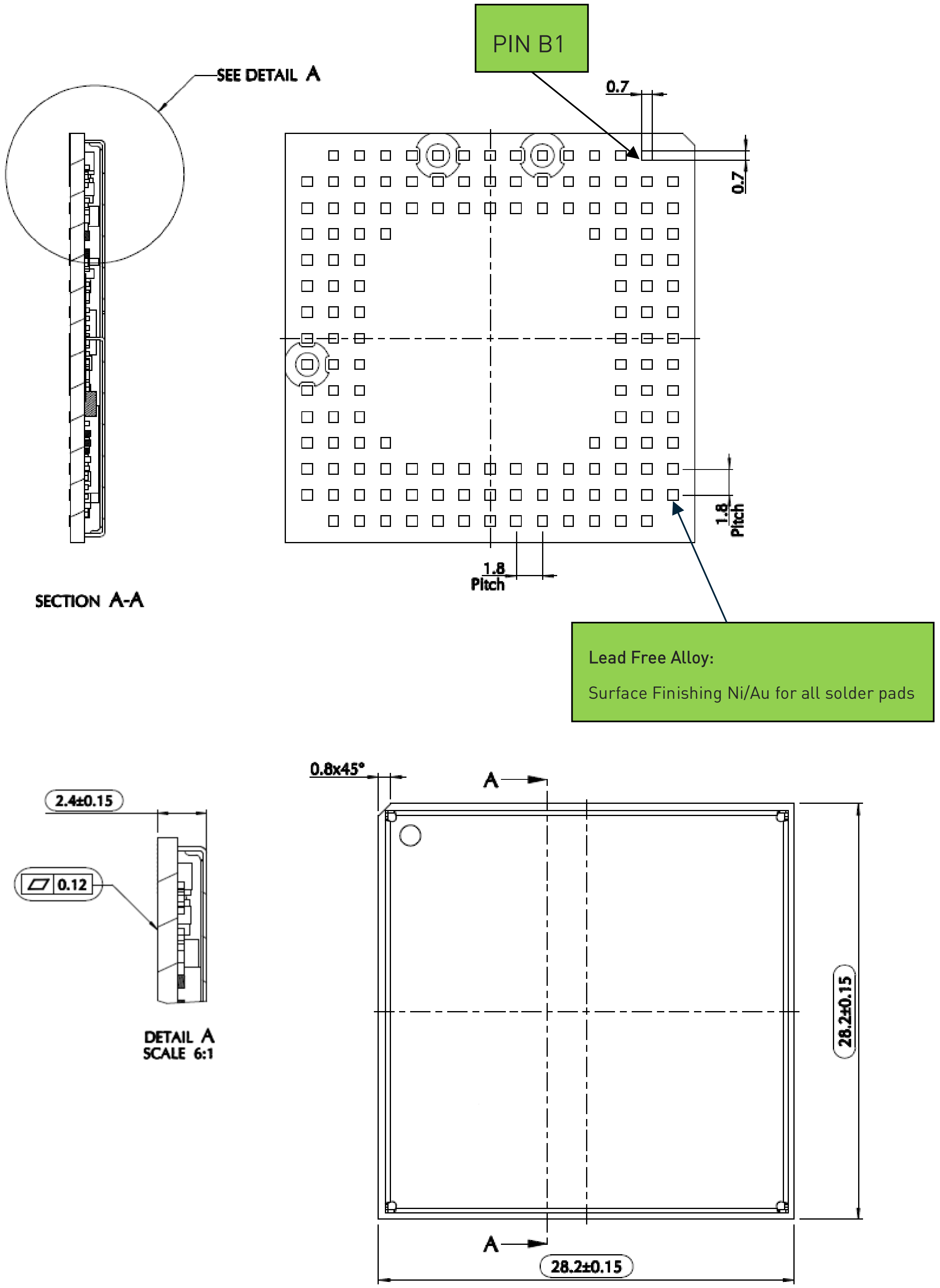
The table below specifies the GNSS characteristics and expected performance:

Parameters		Typical Measurement	Notes
Sensitivity	Tracking Sensitivity	-159 dBm	
	Navigation	-155 dBm	
	Cold Start	-144 dBm	
TTFF	Hot	N/A	It will be available in next revision
	Warm	<30s	GNSS Simulator test @-130dBm
	Cold	<30s	GNSS Simulator test @-130dBm
Min Navigation update rate		1Hz	
CEP		<2m	

Table 37: GNSS characteristics

9. MECHANICAL DESIGN

9.1. Drawing



PIN B1

Lead Free Alloy:

Surface Finishing Ni/Au for all solder pads

Figure 24: ME910G1 Mechanical Drawing (without label applied)

10. APPLICATION PCB DESIGN

The ME910G1 modules have been designed to be compliant with a standard lead-free SMT process

10.1. Recommended Footprint for the Application

Copper Pattern (top view)

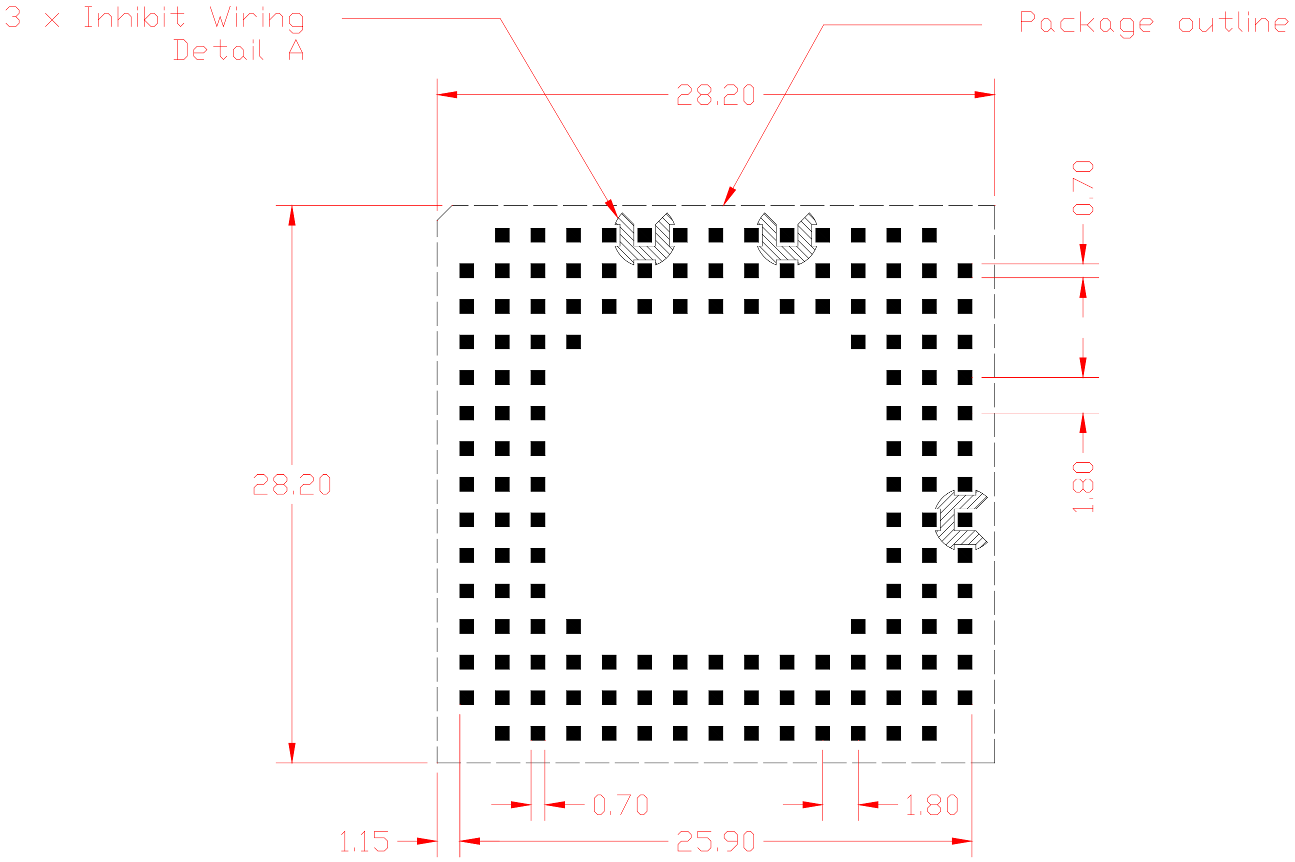
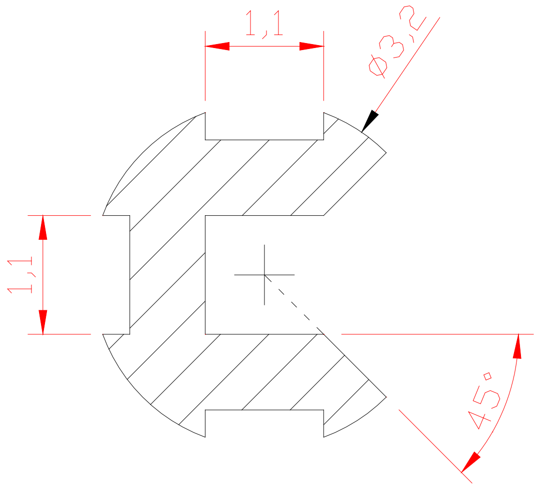


Figure 25: Footprint

INHIBIT WIRING AREA (dimensions in mm)



Detail A

Figure 26:: Inhibit Wiring Area

SOLDER RESIST PATTERN (TOP TRANSPARENT VIEW)

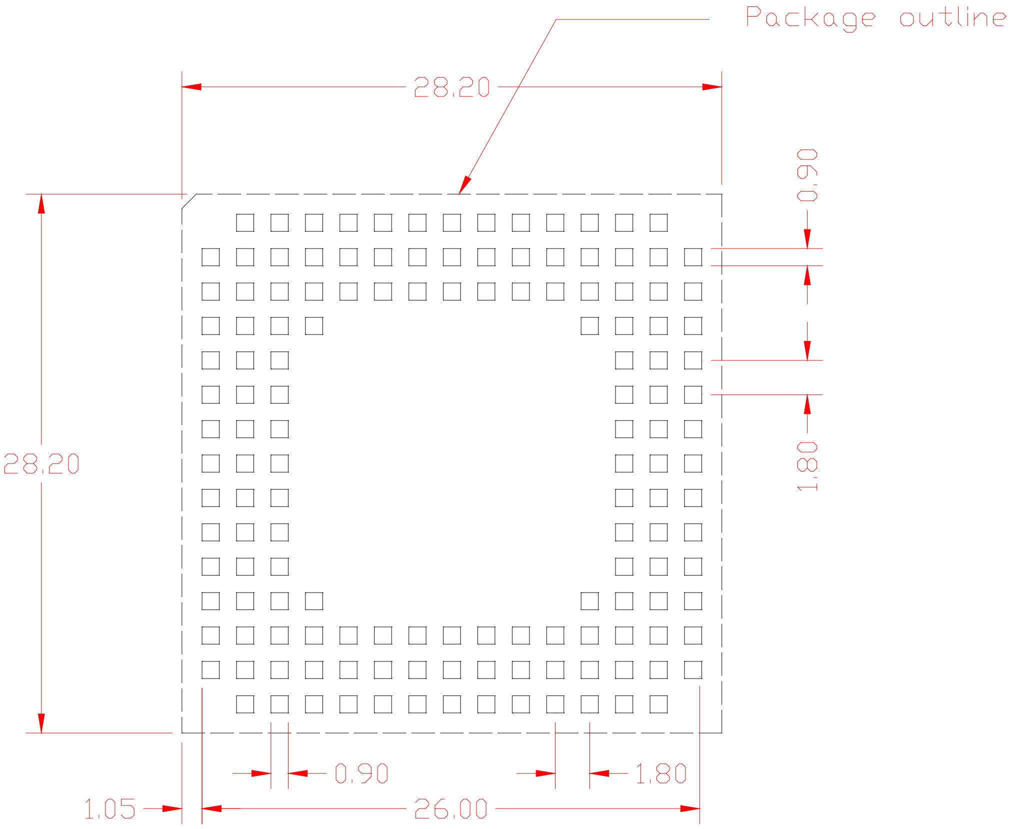


Figure 27: Solder Resist pattern

To easily rework the ME910G1 it is recommended to consider on the application a 1.5 mm placement inhibit area around the module.

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

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

10.2. PCB Pad Design

In PCB design, solder pads can be defined as either Solder Mask Defined (SMD) or Non-Solder Mask Defined (NSMD). The difference between these two solder mask pad definitions is in the proximity of the solder mask to the metal pad. In SMD pads, the solder mask opening is smaller than the metal pad and overlaps the metal on all sides. The opening of the solder mask defines the solderable area of the pad. In NSMD pads, the opening of the solder mask is larger than the metal pad and does not overlap the metal. The metal edge defines the solderable area of the pad (see Figure below).

Since the metal etching process in PCB manufacture, has significantly tighter alignment and etching tolerances than solder masking process alignment registration, which, a more accurate solder pad land pattern can be obtained with NSMD pads. Also, with SMD pads, the solder mask overlapping the metal pad introduces additional height above the metal surface which may the adhesion and reliability of the solder joint. Non solder mask defined (NSMD) type is recommended for the solder pads on the PCB.

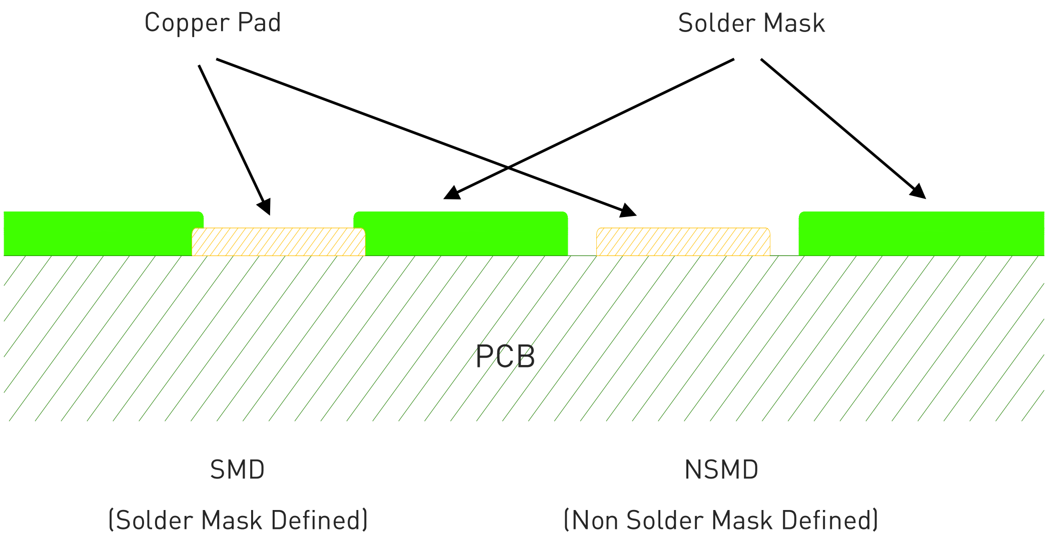


Figure 28: PCB solder pad recommendations

10.3. Recommendations for PCB Pad Dimensions

It is not recommended to place vias or micro-vias not covered by solder resist in an area of 0,3 mm around the pads unless they are transmitting the same signal of the pad itself

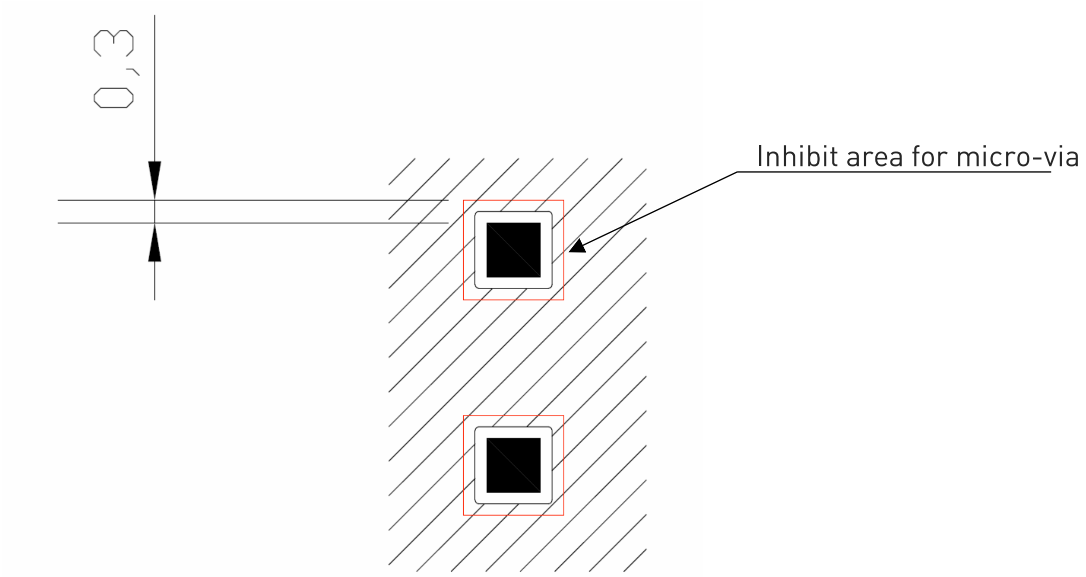


Figure 29: Pad dimensions recommendations

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

Recommendations for PCB pad surfaces:

Finish	Layer Thickness (um)	Properties
Electro-less Ni / Immersion Au	3 –7 / 0.05 – 0.15	good solder ability protection, high shear force values

Table 38: Recommendations for PCB pad surfaces

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

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

10.4. Thermal Performance

FR4 is one of the most commonly used PCB materials, it is a flame retardant composite material, composed by fiberglass-reinforced and epoxy laminate. One of the features of the FR4 is that it has a very low thermal conductivity. An inexpensive way to improve thermal transfer for FR-4 PCBs is to add thermal vias - plated through-holes (PTH) between the conductive layers. Vias are created by drilling holes and copper plating them, in the same way that a PTH or via is used for electrical interconnections between layers. A series of plated through-hole thermal vias, should be placed in the GND area under the Telit module of the PCB to provide a thermal connection from the PCB GND to the additional metal layers of the PCB.

The application PCB layout should include plated through-hole thermal vias for efficient heat dissipation from the Telit module into the PCB. One of the following types of thermal vias should be used:

- Open plated through-hole vias which will provide lower PCB fabrication costs but may fill with solder.
- Plugged and capped plated through-hole vias that will provide higher PCB fabrication costs but will not fill with solder.

Telit recommends creating areas of 10 mil (0.254-mm) vias arranged on a 25 mil (0.635-mm) rectilinear matrix. The reason for this choice is the combination of cost, performance and manufacturability. According to several PCB manufacturers, 10-mil holes and 25-mil spacing are reasonable and repeatable production choice.

A uniform thickness of the metal plating on the PCB will ensure reliable, high Telit module solder assembly yield.

10.5. Stencil

A silk-screen process will be required for the deposition of solder paste to the PCB, for the reflow of the Telit module to the PCB. The silk-screen process requires the use of an aperture based metal stencil where the solder paste is transferred through the openings on the solder pads of the application PCB. To minimize solder voids and ensure maximum electrical and thermal connectivity of the module to the PCB, large pads, solder volume, and solder deformation must be considered when designing the stencil. The design and manufacture of the stencil determines the quality of the solder paste deposition on the PCB and the resulting solder joint after reflow. The primary stencil parameters are the size of the opening, the thickness and the method manufacture. The stencil should be made of stainless steel and the openings layout can be the same of the recommended footprint (1:1). The recommended thickness shall be 127 um (5 mil). A stencil thickness of 152 µm (6 mil) can be used as well.

10.6. Solder Paste

Various types and grades of solder paste can be used for surface mounting Telit modules. For leadfree applications, a Sn-Ag (SA) or Sn-Ag-Cu (SAC) solder paste can be used. Any Type 3 solder paste either water-soluble or no clean is acceptable.

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

10.7. Solder Reflow

Recommended solder reflow profile:

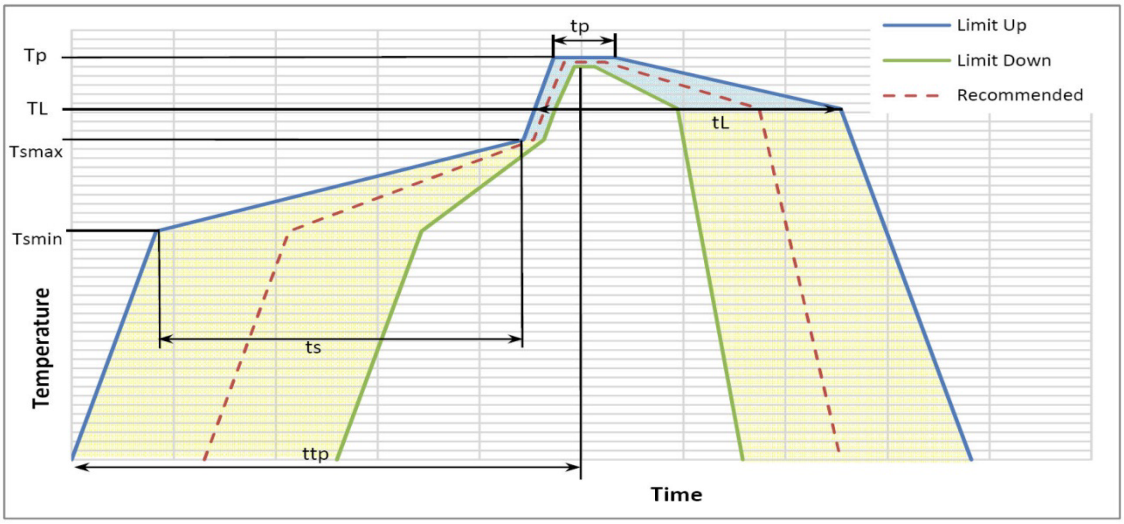


Figure 30: Recommended solder reflow profile

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.

Table 39: Profile feature recommendations

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

Warning: THE ME910G1 MODULE WITHSTANDS ONE REFLOW PROCESS ONLY.

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

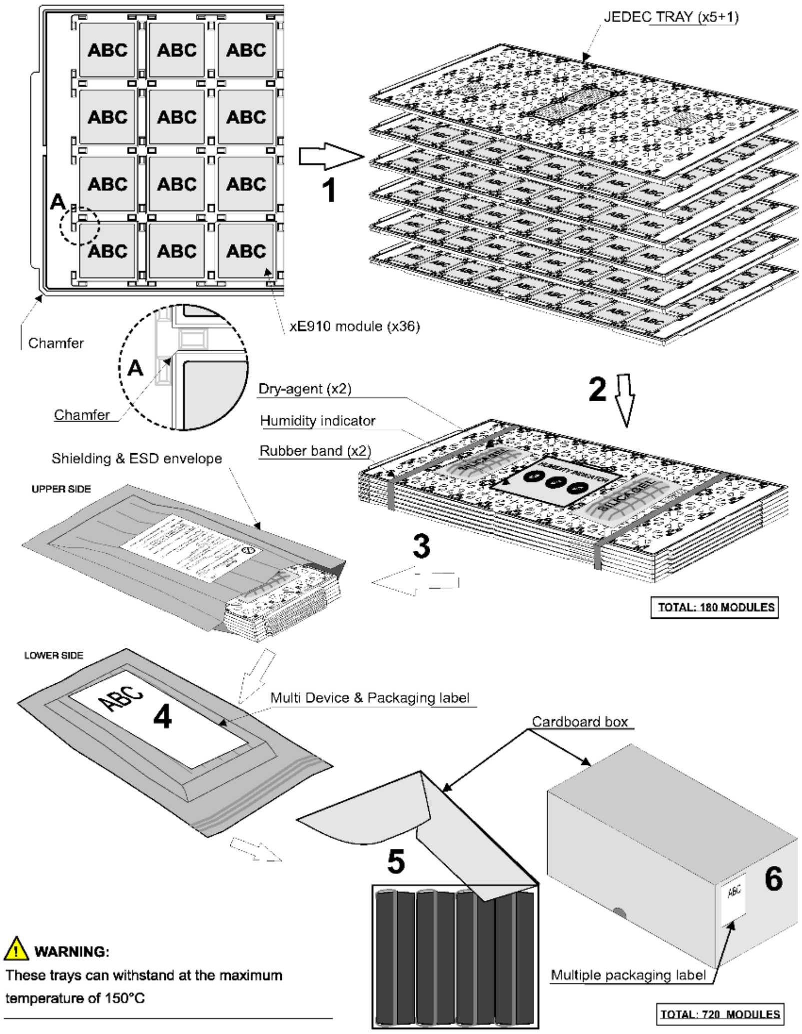
10.8. Inspection

An inspection of the solder joint between the solder pads of the Telit module and the application PCB should be performed. The best visual inspection tool for Telit module solder joints inspection on PCB is X-ray transmission, which can identify defects such as solder bridging, shorts, openings and large voids (Note: the small voids in large solder joints are not detrimental to the reliability of the solder joint).

11. PACKAGING

11.1. Tray

ME910 modules are packaged on trays that can be used in SMT processes for pick & place handling.The first Marketing and Engineering samples of the ME910G1 series will be shipped with the current packaging of the xE910 modules (on trays of 20 pieces each). Please note that Telit is going to introduce a new packaging for the xE910 family, as per Product Change Notification PCN-0000-14-0055, therefore the mass production units of ME910G1 will be shipped according to the following drawings:



WARNING:
These trays can withstand at the maximum temperature of 150°C

Figure 31: Tray packaging

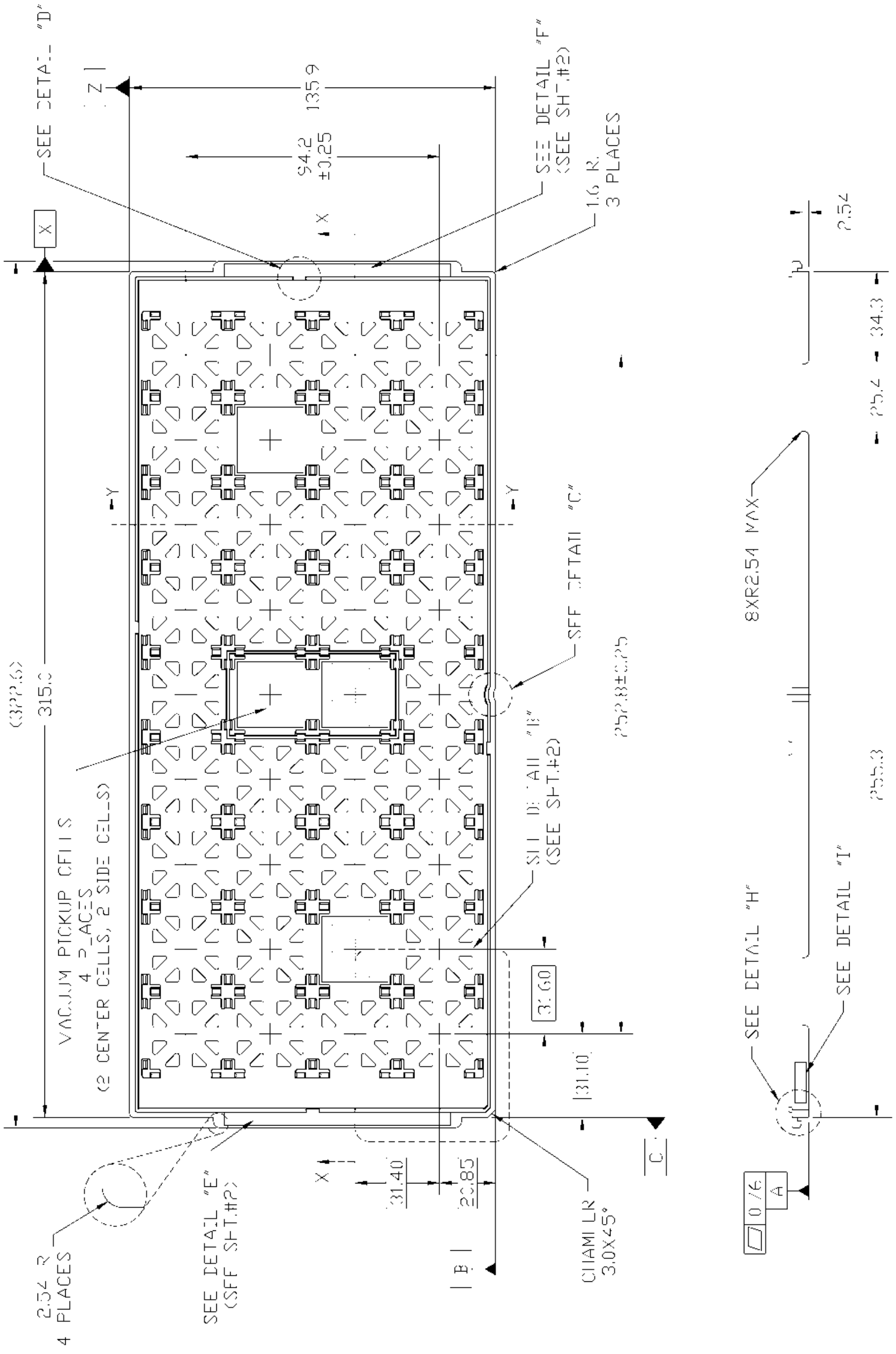


Figure 32: Tray dimensions

11.2. Reel

The ME910 can be packaged on reels of 200 pieces each. See figure for module positioning into the carrier.

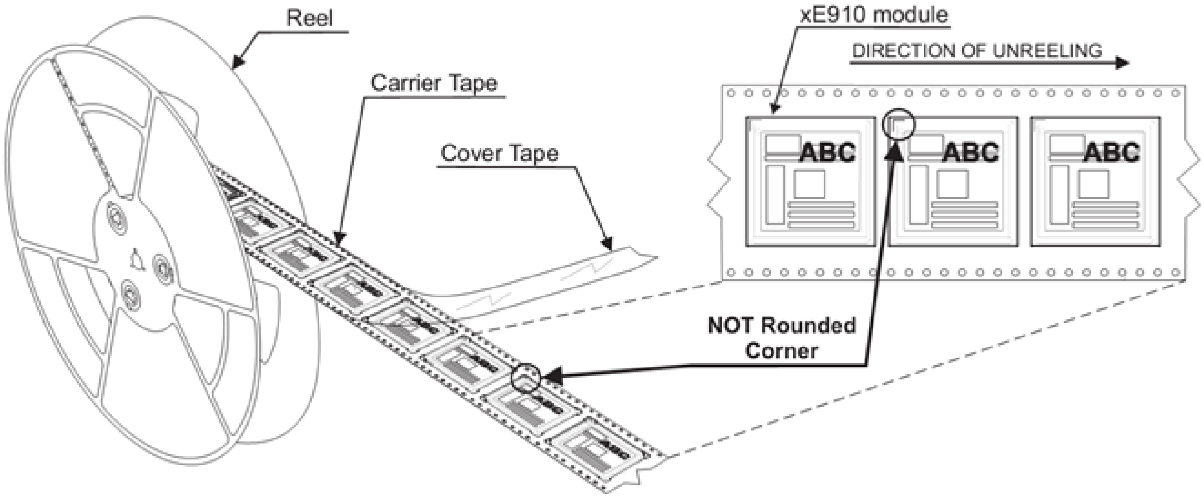


Figure 33: Module positioning into the carrier

11.3. Carrier Tape Detail

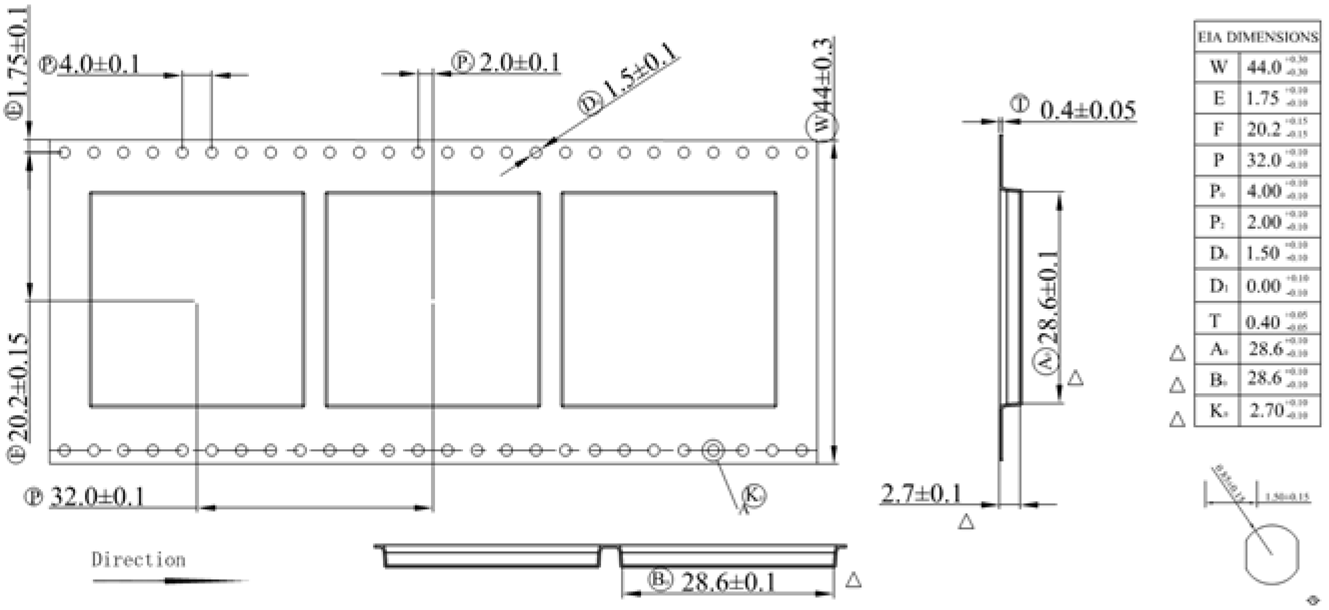


Figure 34: Carrier Tape detail

11.4. Reel Detail

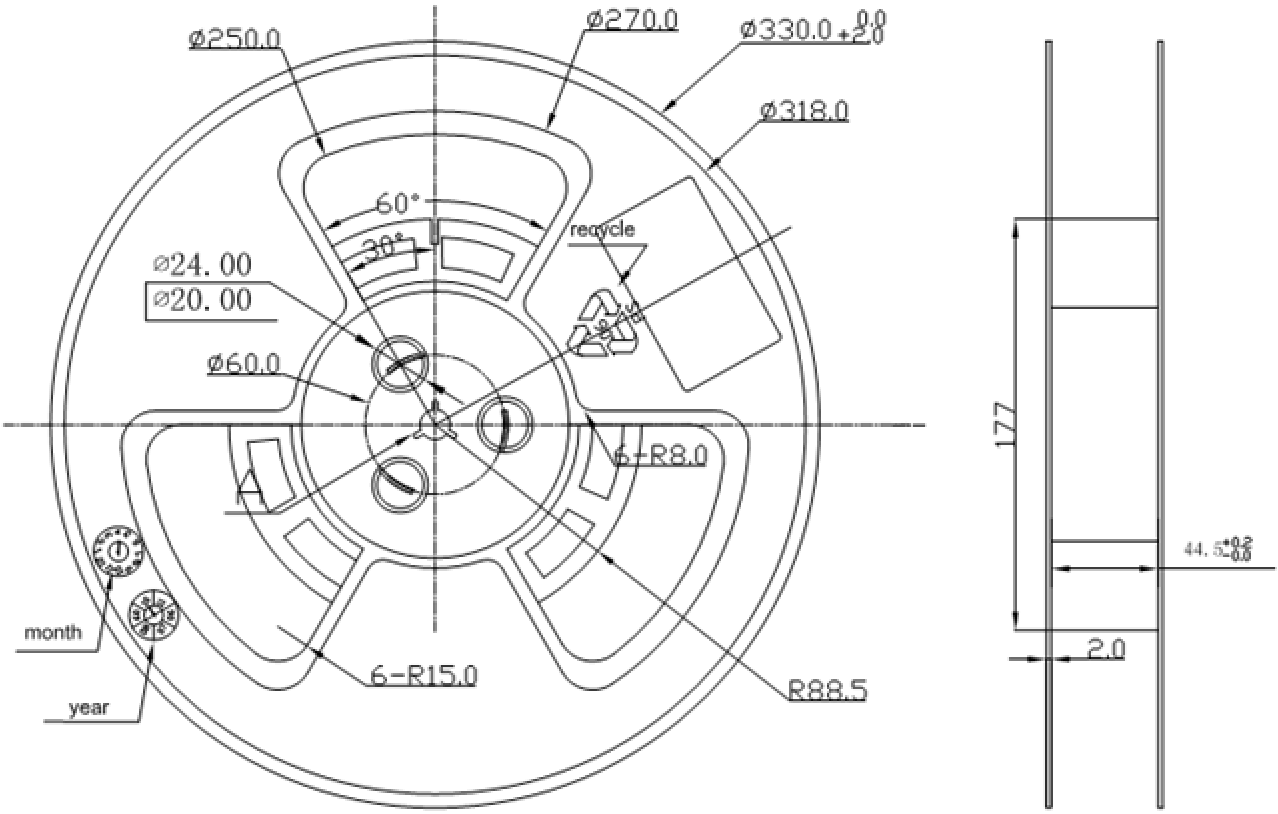


Figure 35: Reel detail

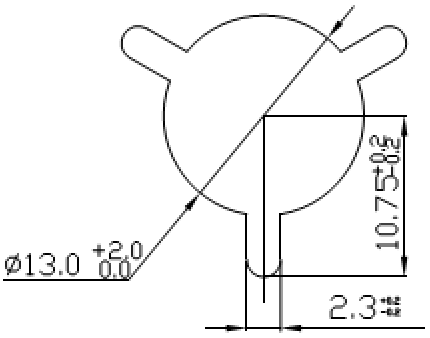


Figure 36: Detail

11.5. Packaging Detail

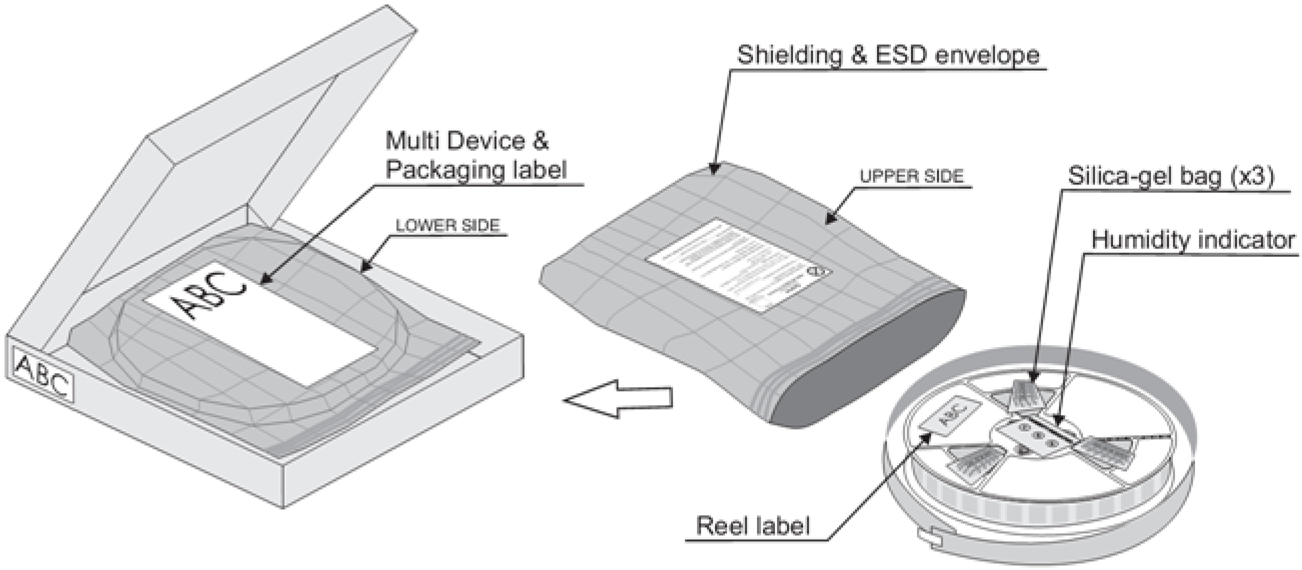


Figure 37: Packaging detail

11.6. Moisture Sensitivity

The ME910G1 is a level 3 Moisture Sensitive Device, in accordance with the standard IPC/JEDEC J-STD-020, it takes care of all related requirements for using this kind of components.

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

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

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

c) The maximum time between opening 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

12. CONFORMITY ASSESSMENT ISSUES

12.1. Approvals Summary

Region	EMEA	
Country & Type Approval	EU RED	UK UKCA
ME910G1-W1	●	●
ME910G1-WW	●	●
ME910G1-WWV	●	●
ME910G1-W3	●	●

Table 40: EMEA Approvals summary

Region	Americas		
Country & Type Approval	US FCC	CA ISED	BR ANATEL
ME910G1-W1	●	●	
ME910G1-WW	●	●	●
ME910G1-WWV	●	●	
ME910G1-W3	●	●	

Table 41: Americas Approvals summary

Region	APAC				
Country & Type Approval	JAP JRF / JTBL	CH CCC	KOREA KCC	SG IMDA	TW NCC
ME910G1-W1					
ME910G1-WW	●	●	●	●	●
ME910G1-WWV					
ME910G1-W3					

Table 42: APAC Approvals summary

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

12.2. EMEA Approvals

12.2.1. EU RED

12.2.1.1. 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

12.2.1.2. 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
ME910G1-W1	Omnidirectional Antenna Gain 2.14 dBi
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 43: RED Antenna Type

Max Gain for RED (dBi)				
Band	ME910G1-W1	ME910G1-WW	ME910G1-WWV	ME910G1-W3
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	11.84
FDD 3	14.33	11.33	11.33	11.33
FDD 8	11.45	8.45	8.45	8.45

Max Gain for RED (dBi)				
Band	ME910G1-W1	ME910G1-WW	ME910G1-WWV	ME910G1-W3
FDD 20	11.20	8.20	8.20	8.20
FDD 28	10.47	7.47	7.47	7.47

Table 44: Max Gain for RED

12.2.2. UK UKCA

12.2.2.1. 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

12.2.2.2. RED/UKCA Antennas

This radio transmitter has been approved under UKCA 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 UKCA.

Model	Antenna Type
ME910G1-W1	Omnidirectional Antenna Gain 2.14 dBi
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 45: UKCA Antenna Type

Max Gain for RED/UKCA (dBi)				
Band	ME910G1-W1	ME910G1-WW	ME910G1-WWV	ME910G1-W3
GSM 900	---	---	TBD	---
DCS 1800	---	---	TBD	---
GPRS/EGPRS 900	---	5.47	5.47	---

Max Gain for RED/UKCA (dBi)				
Band	**ME910G1-W1**	**ME910G1-WW**	**ME910G1-WWV**	**ME910G1-W3**
GPRS/EGPRS 1800	---	9.34	9.34	---
FDD 1	14.84	11.84	11.84	11.84
FDD 3	14.33	11.33	11.33	11.33
FDD 8	11.45	8.45	8.45	8.45
FDD 20	11.20	8.20	8.20	8.20
FDD 28	10.47	7.47	7.47	7.47

Table 46: Max Gain for UKCA

12.3. Americas Approvals

12.3.1. USA FCC

12.3.1.1. FCC Certificates

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

12.3.1.2. Applicable FCC and ISED Rules/Liste des Règles FCC et ISDE Applicables

Model *Modèle*	Applicable FCC Rules
ME910G1-W1	47 CFR Part 2, 22, 24, 27, 90
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 47: Applicable FCC rules

12.3.1.3. FCC Regulatory Notices

Modification statement

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.

Interference statement

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.

Wireless notice

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

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. 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.

12.3.1.4. FCC Antenna Info

This radio transmitter has been approved by FCC 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.

Model	Antenna Type
ME910G1-W1	Omnidirectional Antenna Gain 2.14 dBi
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 48: FCC Antenna Type

Max Gain for FCC (dBi)				
Band	**ME910G1-W1**	**ME910G1-WW**	**ME910G1-WWV**	**ME910G1-W3**
GSM 850	---	---	8.4	---
GSM 1900	---	---	10.0	---
GPRS/EGPRS 850	---	6.9	6.9	---
GPRS/EGPRS 1900	---	2.5	2.5	---
FDD 2	11.0	8.0	8.0	8.0
FDD 4	8.0	5.0	5.0	5.0
FDD 5	12.4	9.4	9.4	9.4
FDD 12	11.6	8.6	8.6	8.6
FDD 13	12.1	9.1	9.1	9.1
FDD 14				
FDD 25	11.0	8.0	8.0	8.0
FDD 26	12.3	9.3	9.3	9.3
FDD 66	8.0	5.0	5.0	5.0
FDD 71	11.4	11.4	11.4	---
FDD 85	11.6	8.6	8.6	8.6
FDD 86	12.1	9.1	---	---
FDD 8_39d	11.9	8.9	---	9.8

Table 49: Max Gain for FCC (dBi)

12.3.1.5. FCC 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	FCC ID
ME910G1-W1	Contains FCC ID: RI7ME910G1W1
ME910G1-WW	Contains FCC ID: RI7ME910G1WW
ME910G1-WWV	
ME910G1-W3	Contains FCC ID: RI7ME910G1W3

Table 50:Host device FCC label

12.3.2. Canada ISED

12.3.2.1. ISED Database

The product ISED certified can be found here

Le certificat ISDE est disponible ici:

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

Model *Modèle*	Applicable ISED Rules *Règles ISDE applicables*
ME910G1-W1	RSS: 132 Issue3, 133 Issue 6, 130 Issue 2, 139 Issue 3; RSS-Gen Issue 5
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 51: Applicable ISED rules

12.3.2.2. ISED Regulatory Notices

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

Model *Modèle*	Antenna Type *Type d'Antenne*
ME910G1-W1	Omnidirectional Antenna Gain 2.14 dBi *Omnidirectionelle* *Gain de l'antenne 2.14 dBi*
ME910G1-WW	
ME910G1-WWV	
ME910G1-W3	

Table 52: ISED Antenna Type/ISDE Type d'antenne

Gain maximum pour ISED (dBi) / *Gain maximum pour ISDE (dBi)*				
Bande	ME910G1-W1	ME910G1-WW	ME910G1-WWV	ME910G1-W3
GSM 850			5.1	---
GSM 1900			10.0	---
GPRS/EGPRS 850	---	3.6	3.6	---
GPRS/EGPRS 1900	---	2.5	2.5	---
FDD 2	11.0	8.0	8.0	8.0
FDD 4	8.0	5.0	5.0	5.0
FDD 5	9.1	6.1	6.1	6.1
FDD 12	8.6	5.6	5.6	5.6
FDD 13	8.9	5.9	5.9	6.0
FDD 14				6.0
FDD 25	11.0	8.0	8.0	8.0
FDD 26	9.0	6.0	6.0	6.2
FDD 66	8.0	5.0	5.0	5.0
FDD 71	8.4	8.4	8.4	---
FDD 85	8.6	5.6	5.6	5.6

Table 53: Gain maximum for ISED (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.

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.

Trace antenna designs

See 7.2 GSM/WCDMA/TD-SCDMA/LTE Antenna - PCB Line Guidelines

Summary of the specific operational use conditions

See apart 7.1 GSM/WCDMA/TD-SCDMA/LTE Antenna - Antenna requirements

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 IC label *Ètiquette IC du dispositif hôte*
ME910G1-W1	Contains IC: 5131A-ME910G1W1
ME910G1-WW	Contains IC: 5131A-ME910G1WW
ME910G1-WWV	
ME910G1-W3	Contains IC: 5131A-ME910G1W3

Table 54: Host device IC label / Ètiquette IC du dispositif 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.

12.3.3. Brazil ANATEL

12.3.3.1. ANATEL Regulatory Notices

Agência Nacional de Telecomunicações (ANATEL) of Brazil

ME910G1-WW, ME310G1-WW, ML865G1-WW Homologation #: 08566-20-02618

12.4. APAC Approvals

12.4.1. Taiwan NCC

12.4.1.1. NCC Regulatory Notices

According to NCC Taiwan requirements, the module and the packaging shall be identified as described in the following lines. Shall be added also the specified safety warning statement.

Brand name: Telit

Model name: ME910G1-WW

Equipment name: WWAN module

NCC logo:

NCC ID: CCAF20NB0050T0

NCC safety warning statement: “**減少電磁波影響，請妥適使用**”

NCC Note:
注意：行動電話業務(2G)於106年6月停止提供服務後，本設備2G功能在國內將無法使用。

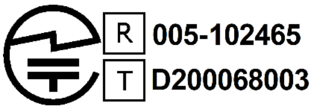
12.4.2. Japan JRL/JTBL

12.4.2.1. JRL/JTBL Regulatory Notices

Antenna info

According to Japan regulatory rule, module certification is valid only with the specific antennas registered to and approved by Japan Radio Law (JRL) certified body in relation to module certification. Customers who are going to use modules under JRL are

According to Japanese JRL/JTBL requirements, the module and the packaging shall display the conformity mark, showing that the terminal equipment has received the certification. The conformity mark is displayed like in the picture below:



R **005-102465**
T **D200068003**

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13.3. Safety Recommendations

Make sure the use of this product is allowed in your country and in 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, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product must be supplied with a stabilized voltage source and the wiring must be conformed to the security and fire prevention regulations. The product must be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions must 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, must 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 must be equipped with a proper antenna with specific characteristics. The antenna must be installed carefully in order to avoid any interference with other electronic devices and must guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator must assess the final product against the SAR regulation.

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 the relevant information is available on the European Community website:

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

14. GLOSSARY

ADC	Analog – Digital Converter
CLK	Clock
CMOS	Complementary Metal – Oxide Semiconductor
CS	Chip Select
DAC	Digital – Analog Converter
DTE	Data Terminal Equipment
ESR	Equivalent Series Resistance
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
MISO	Master Input – Slave Output
MOSI	Master Output – Slave Input
PCB	Printed Circuit Board
RTC	Real Time Clock
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
TTSC	Telit Technical Support Centre
UART	Universal Asynchronous Receiver Transmitter
UMTS	Universal Mobile Telecommunication System
USB	Universal Serial Bus
VNA	Vector Network Analyzer
VSWR	Voltage Standing Wave Radio
WCDMA	Wideband Code Division Multiple Access

15. DOCUMENT HISTORY

Revision	Date	Changes
15	2022-07-27	"B86" has been 3GPP standardized as B103 Antenna aperture Tuning Application note not yet available Added Switched off power consumption CONFORMITY ASSESSMENT ISSUES Chapter updated
14	2022-04-08	Forced USB Boot chapter added B14 removed in chapter 2.5.1 for ME910G1-W1 variant Figure 26: right title set Figure 24: box filled up UKCA for W3 variant Anatel restricted radiation statement removed 2.7.1 thickness without label 9.1 drawing: without label
13	2022-01-13	Added ME310G1-W3 Added RX sensitivity and power consumption UKCA in draft
12	2021-09-24	Chap 1.2 alignment to ME310 HUG Chap 1.5 document list updated Chap 4.3.1.3 change battery peaks of current up to 2A Chap 5.7.3.1 remove indication of SW flow control in the note Chap 12.4 added UCKA reference removed until final approvals from Approved Body UK Language reviewed
11	2021-08-19	**Revision released for certification purpose. Not distributed.** UKCA certification added
10	2021-08-05	Added B86 (US upper 700MHz band) to WW product Chapter 12, update
9	2021-04-22	Added B8_39d (US 900Mhz band) to W1 and WW products
8	2021-02-22	Section 3.2, LGA pads layout correction
7	2021-02-02	Reviewed template design and styles Section 2.4, update Chapter 4, update Sections 6.1, 6.2, 6.3, removed (redundant) Section 7.2, removed

Revision	Date	Changes
		Section 8.4, measurements update Section 2.2, 2.5, 12.3, adding B86 update
6	2020-09-14	Section 2.5, TX Power update Section 2.8, Temperature range update Chapter 12, Conformity assessment update
5	2020-07-22	Conformity assessment update with ANATEL
4	2020-06-18	The title of chapter 5.7.3.2 has been changed from "Modem serial port 2" in "Modem serial port 2 (USIF1)". The title of chapter 5.7.3.1 has been changed from "Modem serial port 1" in "Modem serial port 1 (USIF0)". In the table of chapter 3.1, the "Asynchronous serial port" section title has been changed in "Asynchronous serial port (USIF0)".
3	2020-06-10	Conformity assessment update TX Output Power update Power Consumption section update GNSS Section update Applicability table update
2	2020-01-23	Conformity assessment update Power consumption figures update RX Sensitivity figures update RF Section update Pull-up/down values update
1	2019-08-29	Bands support updating Added ME910G1-WW Temperature range update Added power consumption figures Removed B14 Extended Voltage Range lower limit change
0	2019-04-12	First issue

From Mod.0818 rev.4

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