

# **AL-T51A2-1/AL-T51A2-2**

## **Hardware User Guide**

## Document History

		Change Details		
Revision	Date	Chapter	Section	Description
1.0	2020/8/25	-	-	First edition
2.0	2021/5/10	9	9.3-9.5	FCC ID,ISED ID change

# Contents

<b>1. Scope</b>	<b>4</b>
<b>2. Environmental condition</b>	<b>4</b>
<b>3. Electrical specifications</b>	<b>4</b>
3.1 Absolute maximum ratings	4
3.2 Recommend operating condition	5
3.3 Radio Specifications	5
3.3.1 Cellular Specifications	5
3.3.2 GPS Receiver Specifications	5
<b>4. Module Control</b>	<b>6</b>
4.1 Power off and reset limitations	6
4.2 Power supply interrupt	6
4.3 Over-temperature Protection	6
4.4 Over-temperature Protection (restricted RF operation).	6
<b>5. UART/USB</b>	<b>7</b>
5.1 UART	7
5.1.1 UART1	7
5.1.2 UART2	7
5.1.3 UART3	8
5.1.4 USB	8
5.1.5 HSIC	8
<b>6. Mechanical Information</b>	<b>9</b>
<b>7. Mechanical Drawings</b>	<b>9</b>
<b>8. Warnings</b>	<b>10</b>
8.1 Handling Precautions	10
<b>9. FCC/IC Regulatory notices</b>	<b>11</b>
9.1 Modification statement	11
9.2 Interference statement	11
9.3 RF Exposure Information	11
9.4 IC Regulations	12
9.5 FCC Class B digital device notice	13

## 1. Scope

This document is applied to wireless module of AL-T51A2-1/AL-T51A2-2 for North America.

## 2. Environmental condition

- ( 1 ) Withstand voltage : MAINVCC 5.0V (Not be destructed)  
: USBV 5.7V (Not be destructed)

## 3. Electrical specifications

### 3.1 Absolute maximum ratings

Table3-1. Absolute maximum ratings

Parameter	Rating		Units	Note
	Min	Max		
MAINVCC withstand voltage	-0.3	5.0	V	Applicable within the Operating temperature
USBV withstand voltage	-0.3	5.7	V	Applicable within the Operating temperature Do not supply votage to USB+/USB- pin when USBV is absent.
Digital interface input voltage	-0.3	$V_{IOVCC}+0.3$	V	Applicable within the Operating temperature
Storage Temperature	-40	+85	°C	Tstg

## 3.2 Recommend operating condition

Table3-2. Recommend operating condition

Parameter	Rating		Unit	Note
	Min	Max		
Operation voltage	3.6	4.0	V	Applicable within the Operating temperature includes momentary fluctuations such as ripple and under/over shoot.
USBV input	4.3	5.25	V	Applicable within the Operating temperature

## 3.3 Radio Specifications

### 3.3.1 Cellular Specifications

Unless otherwise specified, values in tables below are determined defined in performance temperature range.

#### <UMTS/HSPA+>

- Frequency band: B1/B2/B4/B5
- Output Power : Power Class 3
- Category : 14

Also, the transmitter/receiver performance conform to 3GPP TS 34.121.

#### <LTE>

- Frequency band: B1/B2/B4/B5/B12/B26
- Output Power : Power Class 3
- Category : 4

Also, the transmitter/receiver performance conform to 3GPP TS36.101, TS36.521-1.

### 3.3.2 GPS Receiver Specifications

Unless otherwise specified, values in tables below are determined defined in performance temperature range.

Table3-4-2. GPS Receiver Specifications

Item	Rating	Note
Receiver sensitivity (Sensitivity of capture)	-137 dBm or less	Receiver sensitivity is defined by the input power when the device can acquire the satellite at a rate of 60%.
Receiver sensitivity (Tracking Sensitivity)	-152 dBm or less	Receiver sensitivity is defined by the input power when the device can acquire the satellite at a rate of 60%.

## 4. Module Control

### 4.1 Power off and reset limitations

There is no limitations to power off and reset.

### 4.2 Power supply interrupt

If MAINVCC drops out of range( $<2.7V \pm 5\%$  1usec typ) then the module is completely shut down. In this case, please execute power-on sequence.

### 4.3 Over-temperature Protection

PM8018 provides over-temperature protection. If PM8018 die temperature greater than 150 °C, the module is completely shut down. Temperature hysteresis is incorporated such that the die temperature must cool significantly ( $<105^{\circ}\text{C}$  typ) before the module can be powered on again. When the module become under  $105^{\circ}\text{C}$ (typ) and a PWR\_N signal is enabled, the module will power up.

Please execute power-on sequence.

### 4.4 Over-temperature Protection (restricted RF operation).

The thermistor built into the module (around Power Amplifier) detects the temperature around it. Based on the detected limited temperature, the module starts or terminates temperature protection and stop transmit/receive functions to prevent devices to be destructed.

## 5. UART/USB

The module has UART1, UART2, UART3, USB and HSIC interface.

### 5.1 UART

The module has 3 of UART interface.

#### 5.1.1 UART1

Communication speed : 2,500,000 bps  
Hard flow control :No  
Parity bit :No  
Start bit :1  
Stop bit :1  
Data bit :8

Table 5-1-1 UART1

Signal name	I/O	Outline
UART1_SUP	I	Module receiving data
UART1_SDN	O	Module sending data
DTR_N	I	CAN $\mu$ →NAD Notification of Communication is possible
DSR_N	O	NAD→CAN $\mu$ Notification of Communication is possible

#### 5.1.2 UART2

UART2 function can be enabled/disabled by CONT1.

(CONT1=Open(High)→UART2 disabled, CONT1=Low→UART2 enabled)

Communication speed : 115,200/460,800/921,600/3,000,000 (bps)

Hard flow control : No  
Parity bit : No  
Start bit : 1  
Stop bit : 1  
Data bit : 8

Table5-1-2 UART2

Signal name	I/O	Outline
C-UART Up	I	Module receiving data
C-UART Dwn	O	Module sending data
CONT1	I	UART2 enabled/disabled control

### 5.1.3 UART3

Communication speed :2,500,000 bps  
 Hard flow control :No  
 Parity bit :No  
 Start bit :1  
 Stop bit :1  
 Data bit :8

Table5-1-3 UART3

Signal name	I/O	Outline
DBG_UART_TX	I	Module receiving data
DBG_UART_RX	O	Module sending data
GPIO_01 (UART3_DTR)	I	CAN $\mu$ →NAD Notification of Communication is possible
GPIO_02 (UART3_DSR)	O	NAD→CAN $\mu$ Notification of Communication is possible

### 5.1.4 USB

The module has USB 2.0 interface.

USB 2.0 operates at 480Mbps called high speed.

USBV terminal controls USB operation such as operating/non-operating.

Table5-1-4 USB

Signal name	I/O	Outline
USBV	I	Power supply for USB
USB+	Both	positive USB positive signal
USB-	Both	negative USB negative signal

### 5.1.5 HSIC

The module has HSIC ver.1.0 interface.

Table5-1-5 HSIC

Signal name	I/O	Outline
HSIC_STROBE	Both	HSIC STROBE signal
HSIC_DATA	Both	HSIC DATA signal
ETHERNET_RST	O	HSIC RESET signal



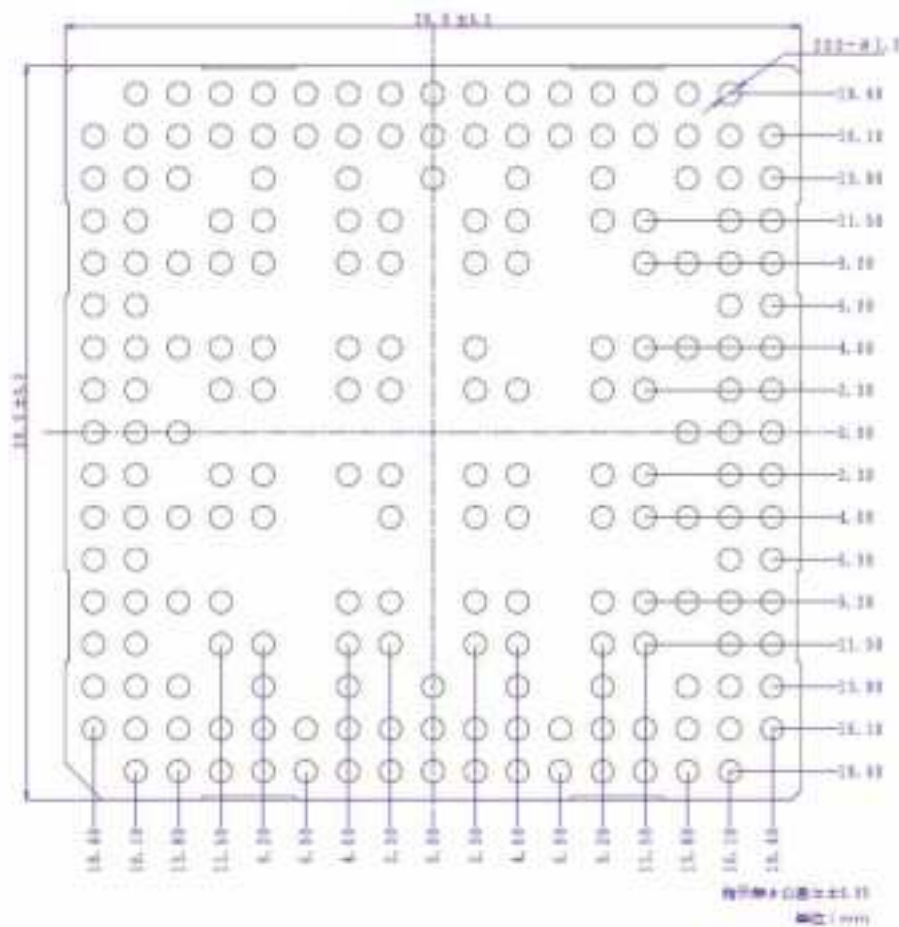
## 6.Mechanical Information

Table6. Mechanical Information

Parameter	Specifications	Definition
Dimensions	D= 39.9±0.2mm W= 39.9±0.2mm H= 4.2+0.55/-0.2mm	
Flatness	0.1mm or less	
Weight	approx. 11+/-2g	

## 7.Mechanical Drawings

Figure. 7-1 Bottom view with dimensions



## 8. Warnings

### 8.1 Handling Precautions

The product is neither intended nor warranted for use in equipment or systems that require a malfunction or failure of which may cause loss of human life, bodily injury.

- 1) Take care of static electricity when handling the product. Failure to do so may cause malfunction.
- 2) Do not expose the product to strong impacts such as by dropping.  
Do not expose the product to wet.  
Do not use the product under stresses beyond absolute maximum ratings, operating voltage and operating temperature.  
It is not the scope of our guarantee and repairs for unsatisfactory results due to installation structure, misuse or inadequate usage of products in the catalog.

Do not disassembly, modifications or repairs. Doing so may cause the product to rupture, catch fire, generate-heat or electric shock. Disassembly or modifications constitutes a violation of the Radio Act.

- 3) Storage temp:  $25\pm 10^{\circ}\text{C}$ , Storage humidity: 60%RH, Storage period: 12 months or less at a dry packaging.  
After opening, you should mount the products while keeping them on the condition of  $25\pm 10^{\circ}\text{C}$  and 60%RH or less in humidity within 3 days.
- 4) When the above-mentioned storage method could not be executed, please process the baking treatment before mounting the products.  
Recommended condition :  $90^{\circ}\text{C} +8/-0^{\circ}\text{C}$  ,  $\leq 5\%$  RH , 37-61 hours
- 5) The module is classified as MSL4.

## 9. FCC/ISED Regulatory notices

### 9.1 Modification statement

The user is cautioned that changes or modifications not expressly approved by the manufacture could void the user's authority to operate the equipment.

### 9.2 Interference statement

This device complies with Part 15 of the FCC Rules and Industry Canada license-exempt RSS standards. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

### 9.3 RF Exposure Information

#### **Requirement to end product.**

This Modular Approval is limited to OEM installation for module and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time-averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of §2.1091.

1. Antenna

The antennas used for this transmitter must be installed to provide a separation distance of least 20cm from all persons.

2. Co-location

This module must not be collocated or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

3. Caution to user for modification

The end user has no manual instructions to remove or install the device and a separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

According to the MPE RF explore report, maximum antenna gain allowed for use with this device is

FDD I	: 3.1 dBi
FDD II	: 3.1 dBi
FDD IV	: 2.6 dBi
FDD V	: 3.8 dBi
FDD XII	: 3.1 dBi
FDD XXVI	: 3.8 dBi

#### 4. Markings

When the module is installed in a customer's product, the FCC ID label on the module will not be visible. To avoid this case, an exterior label must be stuck on the surface of the customer's product to indicate the FCC ID of the enclosed module. This label can use wording such as the following:

Contains Transmitter module FCC ID: JOYCW1011

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. Otherwise, a second label must be placed on the outside of the final device.

## 9.4 ISED Regulations

### IC Radiation Exposure Statement:

This equipment complies with ISED RSS-102 radiation exposure limits set forth for uncontrolled environment.

#### 1. Antenna

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

#### 2. Co-location

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

#### 3. Compliance statement to ISED

This Class B digital apparatus complies with Canadian ICES-003. Under ISED regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equipment isotropically radiated power (e.i.r.p) is not more than necessary for successful communication.

#### 4. Labeling Requirements for the Host Device (from Section 3.2.1, RSS-Gen, Issue 4, November 2014)

The host device shall not be properly labeled to identify the module within the host device. The ISED certification must be labeled to display the ISED certification number of the module, preceded by the words – Contains transmitter module, or the word – Contains, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 574B-CW1011

#### 5. Caution to user for modification

This radio transmitter (IC: 574B-CW1011) has been approved by ISED to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antenna type list

-Shark Type: 86769-459B1 (YOKOWO)

-Rod Type: TG.30.8113 (Taoglas)

## 9.5 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 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 interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on circuit different from that to which the receiver is connect.
4. Consult the dealer or an experienced radio/TV technician for additional suggestions.

### **Federal Communication Commission Interference Statement**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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

**FOR MOBILE DEVICE USAGE (>20cm/low power)**

**Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

**This device is intended only for OEM integrators under the following conditions:**

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and **(if EUT is portable device, please delete this item)**
- 2) The transmitter module may not be co-located with any other transmitter or antenna.
- 3) Module approval valid only when the module is installed in the tested host or compatible series of host which have similar RF exposure characteristic with equal or larger antenna separation distance.

As long as **3** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

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

**End Product Labeling****FOR MOBILE DEVICE USAGE (>20cm/low power)**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID:JOYCW1011”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

