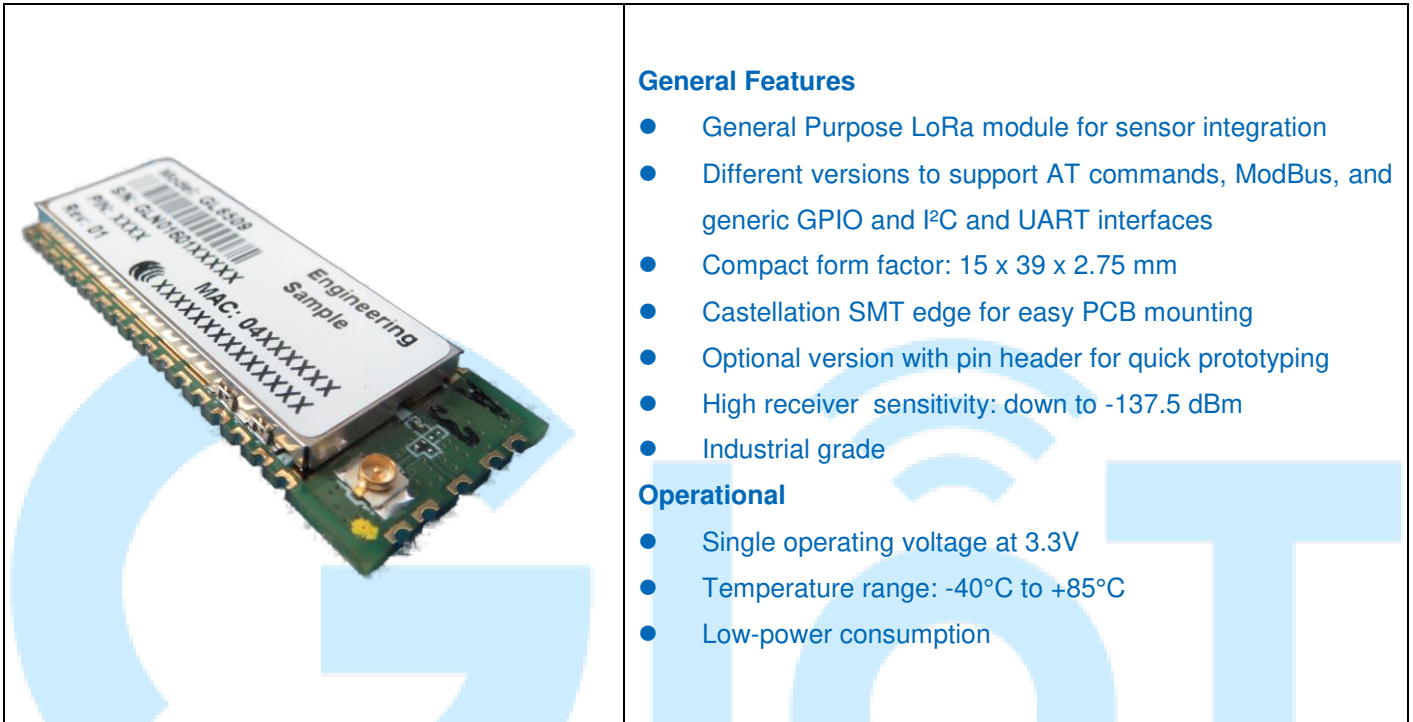


## Low-Power WAN Module GL6509



### General Features

- General Purpose LoRa module for sensor integration
- Different versions to support AT commands, ModBus, and generic GPIO and I<sup>2</sup>C and UART interfaces
- Compact form factor: 15 x 39 x 2.75 mm
- Castellated SMT edge for easy PCB mounting
- Optional version with pin header for quick prototyping
- High receiver sensitivity: down to -137.5 dBm
- Industrial grade

### Operational

- Single operating voltage at 3.3V
- Temperature range: -40°C to +85°C
- Low-power consumption

This LPWAN Module GL6509 is a general purpose SMT module for sensor integration. Sensor vendors can speed up their LPWAN integration by embedding this module in their designs. This module will take care of the LPWAN communication with our LPWAN AP and cloud services. There are different integration options: the sensor design can integrate this SMT module via AT command set treating this module as a LPWAN modem; the interface can be via Modbus interface; and the entire sensor be controlled by the MCU of the module through GPIO or I<sup>2</sup>C or UART.

This GL6509 Module complies with the LoRaWAN Class A protocol specifications. It integrates RF, a Low-Power Long Range transceiver and an application MCU. Together with the integration to our LPWAN gateway and back-end cloud service, making this a total IOT network solution.

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# 1 MODULE OVERVIEW

The GL6509 module is based on LoRa technology to provide low power long range communication using spread spectrum. This provides very high receive sensitivity enabling communication with high interference immunity.

Using LoRa modulation, depending on the spreading factor (SF), GL6509 can achieve system receiver sensitivity of -137.5 dBm.

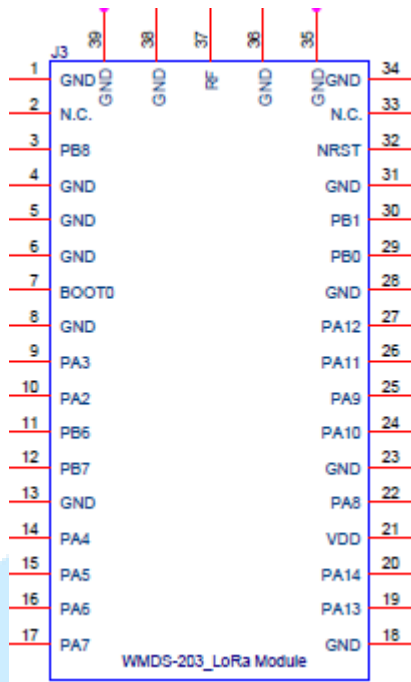
**TABLE 1-1: RECEIVER SENSITIVITY OF SYSTEM WITH 125 KHz MODE(UPLINK WITH SX1257)**

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-130.0
8	3125	-132.5
9	1758	-135.0
10	977	-137.5

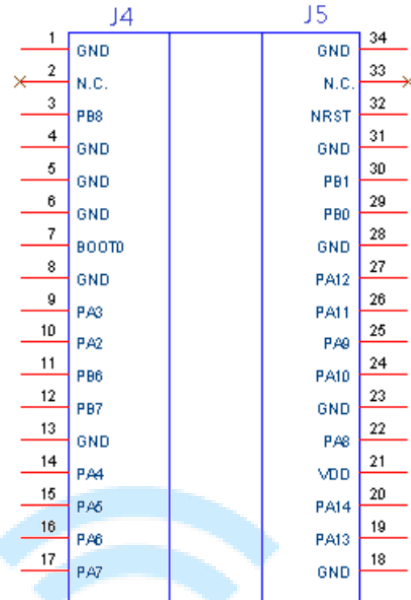
**TABLE 1-2: RECEIVER SENSITIVITY OF MODULE WITH 125 KHz MODE(DOWNLINK)**

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-125.0
8	3125	-128.0
9	1758	-131.0
10	977	-134.0

**FIGURE 1-1: GL6509 SMT PIN DIAGRAM(Top View)**



**FIGURE 1-2: GL6509 PIN HEADER PIN DIAGRAM(Top View)**



**TABLE 1-2: SMT PIN DESCRIPTION**

Pin	Name	Type	Description
1	GND	Power	System Ground
2	N.C.	---	Not Connected
3	PB8	Input/Output	GPIO_1
4	GND	Power	System Ground
5	GND	Power	System Ground
6	GND	Power	System Ground
7	BOOT0	Input	Reserved for debug. Not Connected.
8	GND	Power	System Ground
9	PA3	Input/Output	GPIO_2
10	PA2	Input/Output	GPIO_3
11	PB6	Input/Output	GPIO_4

12	PB7	Input/Output	GPIO_5
13	GND	Power	System Ground
14	PA4	Input/Output	GPIO_6
15	PA5	Input/Output	GPIO_7
16	PA6	Input/Output	GPIO_8
17	PA7	Input/Output	GPIO_9
18	GND	Power	System Ground
19	PA13	Input / Output	SWDIO (Debug Port)
20	PA14	Input	SWCLK (Debug Port)
21	VDD	Power	Positive supply
22	PA8	Input/Output	GPIO_10
23	GND	Power	System Ground
24	PA10	Input	Communication USART1 Transmit (RX)
25	PA9	Output	Communication USART1 Receive (TX)
26	PA11	Input/Output	GPIO_11
27	PA12	Input/Output	GPIO_12
28	GND	Power	Supply Ground
29	PB0	Input/Output	GPIO_13
30	PB1	Input/Output	GPIO_14
31	GND	Power	System Ground
32	NRST	Input	MCU Reset
33	N.C.	---	Not Connected
34	GND	Power	Supply Ground
35	GND	Power	Supply Ground
36	GND	Power	Supply Ground
37	RF	RF Analog	RF RX/TX pin
38	GND	Power	Supply Ground
39	GND	Power	Supply Ground

## 2 GENERAL SPECIFICATIONS

Table 2-1 provides the general specifications for the module. Table 2-2, Table 2-3 and Table 2-4 provide the electrical characteristics, current consumption and output power of Tx power setting.

**TABLE 2-1: GENERAL SPECIFICATIONS**

	Specifications
Modulation Method	LoRa® Technology modulation
Maximum Over-the-Air Data Rate	5469 bps
RF connection	UFL Connector
Interface	UART (reserve for UART*1, I2C*1, SPI*1)
Sensitivity at 10 % BER	-137.5 dBm @ Lora Modulation, BW = 125K, SF = 10
Temperature	-40°C to + 85°C(Operating) 40°C to + 125°C(Storage)
Humidity	10% ~ 90% non-condensing

**TABLE 2-2: ELECTRICAL CHARACTERISTICS**

Parameter	Min.	Typ.	Max.	Units
Supply Voltage, VDD	2.5	---	3.6	V
Voltage on any pin with respect to VSS (except VDD)	-0.3	---	VDD + 0.3	V
Output current sunk by any I/O and control pin	---	---	25	mA
Output current sourced by any I/O and control pin	---	---	-25	mA
Input low level voltage, VIL	---	---	0.3VDD	V
Input high level voltage, VIH	0.7VDD	---	---	V
Output low level voltage for an I/O pin, VOL	---	---	1.3	V
Output high level voltage for an I/O pin, VOH	VDD-1.3	---	---	V
RF Input Level	---	---	+10	dBm

**TABLE 2-3: CURRENT CONSUMPTION**

Mode	Typical current at 3V (mA)
Standby	20
Receive	30
Deep Sleep	0.0043

**TABLE 2-4: OUTPUT POWER OF TX POWER SETTING (BW=125KHZ)**

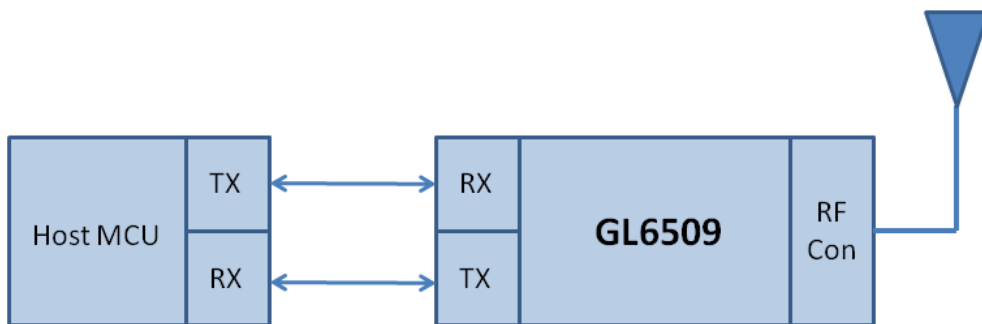
Band	TX Power index	Output Power(dBm)	Current Consumption @ VDD = 3.3V(mA)
915 MHz	2	2.3	48
	3	3.27	50
	4	4.4	52
	5	5.41	54
	6	6.52	56
	7	7.65	58
	8	8.63	60
	9	9.65	62
	10	10.76	66
	11	11.73	69
	12	12.76	73
	13	13.75	77
	14	14.74	81
	15	15.65	87
	16	16.51	95
	17	17.29	105
	18	17.83	113
	19	18.54	123
	20	19.15	135



### 3 TYPICAL HARDWARE CONNECTIONS

Figure 3-1 shows the typical hardware connections where GL6509 is connected as a modem.

**FIGURE 3-1: HARDWARE CONNECTIONS**



#### 3.1 INTERFACE TO HOST MCU

A typical application of GL6509 is to use the UART connection to communicate with a host controller. In this application, the GL6509 is treated as a LoRa modem.

**TABLE 3-1: DEFAULT UART SETTINGS**

Specification	Description
Baud Rate	9600 bps
Data Length	8 bits
Parity Bit	No
Stop Bits	1 bit
Hardware Flow Control	No

### 3.2 GPIO AND INTERRUPT PINS

The GL6509 has 14 GPIO pins.

### 3.3 ANTENNA CONNECTIONS

There are two versions of antenna connectivity: one via the U.FL connector and the other via the SMT pin (RF Pin 37).

### 3.4 POWER PIN

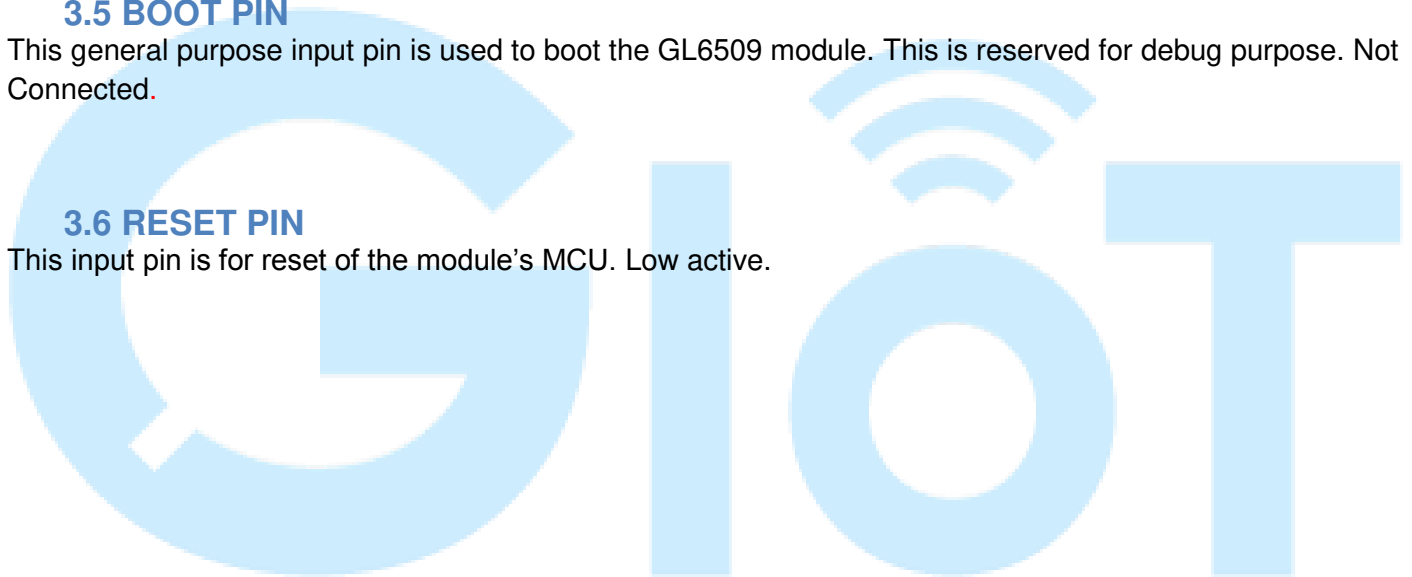
It is recommended that all the power related pins are connected.

### 3.5 BOOT PIN

This general purpose input pin is used to boot the GL6509 module. This is reserved for debug purpose. Not Connected.

### 3.6 RESET PIN

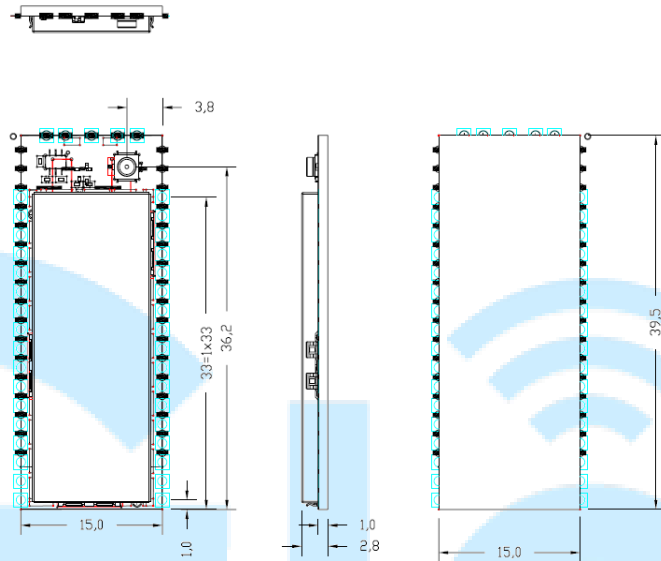
This input pin is for reset of the module's MCU. Low active.



## 4 PHYSICAL DIMENSIONS

Figures 4-1 and 4-2 show the physical dimensions for both the SMT and the PIN Header mounted versions. Figure 4-3 shows the module PCB footprint, Figure 4-4 shows the module PIN Header type Pin Number.

**FIGURE 4-1: GL6509 SMT DIMENSIONS**



**FIGURE 4-2: GL6509 PIN HEADER VERSION DIMENSIONS**

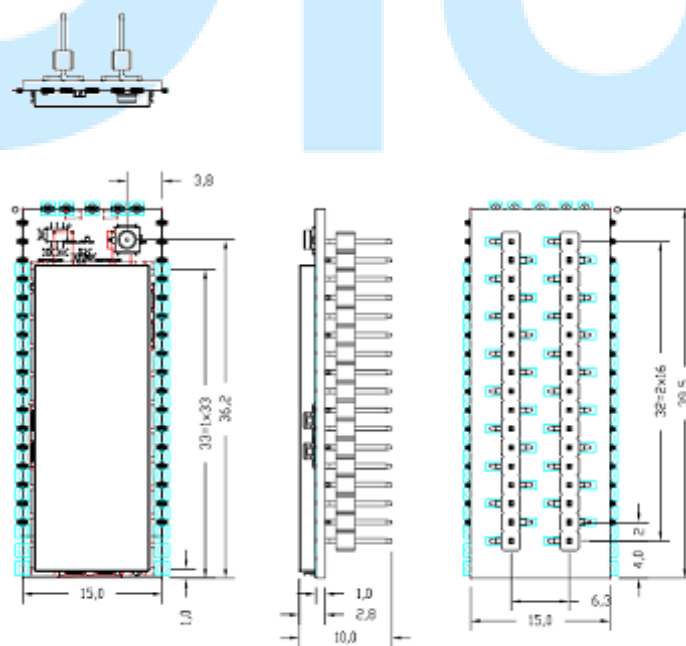


FIGURE 4-3: GL6509 SMT Type Recommend PCB Footprint.

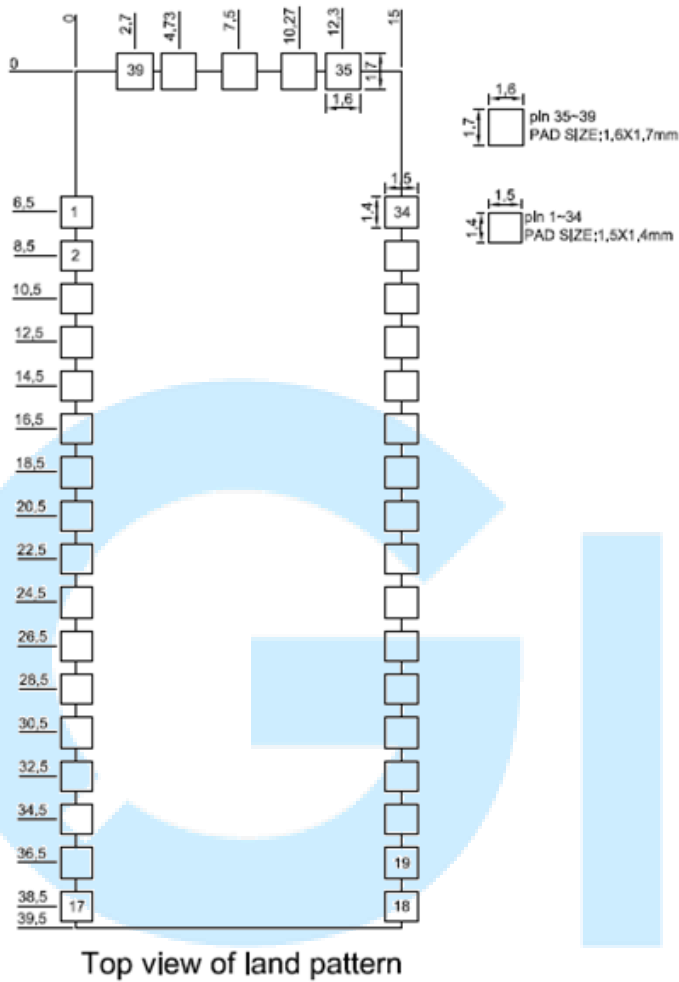
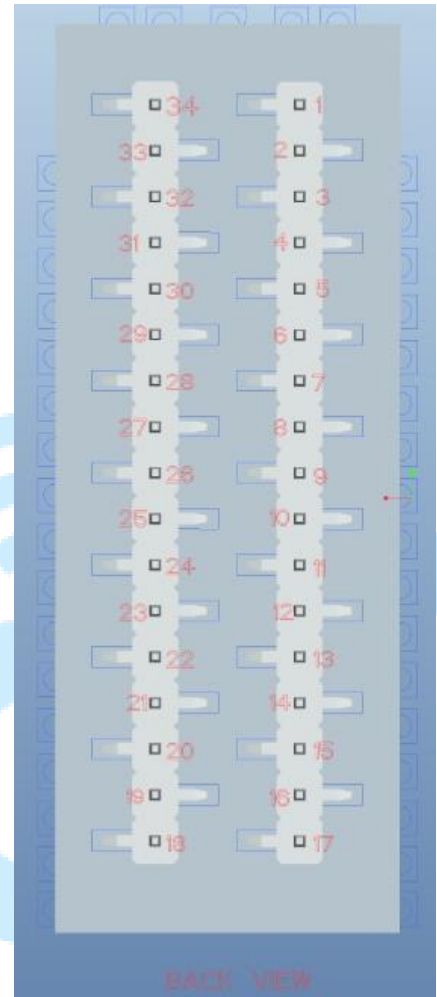


FIGURE 4-4: GL6509 PIN Header Type Pin Number (Bottom view).




## 5 REGULATORY INFORMATION

### 5.1 NCC

第十二條→經型式認證合格之低功率射頻電機，非經許可，公司，商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條→低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

1. 本模組於取得認證後將依規定於模組本體標示審驗合格標籤
2. 系統廠商應於平台上標示「本產品內含射頻模組： CCAFXXLPXXXXTX)」字樣

### 5.2 FCC

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

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 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.

**IMPORTANT NOTE:**

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

Country Code selection feature to be disabled for products marketed to the US/CANADA

Operation of this device is restricted to indoor use only

**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
- 2) The transmitter module may not be co-located with any other transmitter or antenna,

As long as 2 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**

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: **MXF-WMDS-203**".

**Manual Information to the End User**

The OEM integrator has to be aware not to provide information to the end user regarding 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/warning as show in this manual.

## PRODUCT IDENTIFICATION SYSTEM

**GL6509\_A\_M\_U**

**GL6509**: for Gemtek LoRa module model name

**A**: for AT Commands; **M**: for ModBus; **P**: Programming

**M**: SMT; **P**: Pin Header

**A**: Antenna; **T**: Trace; **U**: U.FL

