



Aquila Solutions Inc.

# **MG401 Module**

## Product Specification

MG401 Module

October 31, 2018

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# 1 Product Overview

The MG401 module is an industrial-grade LTE module, which provides multiple bands support and covers most of LTE bands in North America. This module can be adapted to various types of terminal devices, providing LTE network connection and data communication, such as industrial routers, industrial handsets, tablet computers, laptops, etc.

The MG401 module achieves download rates up to 150Mbps and uplink rates to 50Mbps (FDD).

The MG401 module passed FCC, GCF, PTCRB, IC certifications.

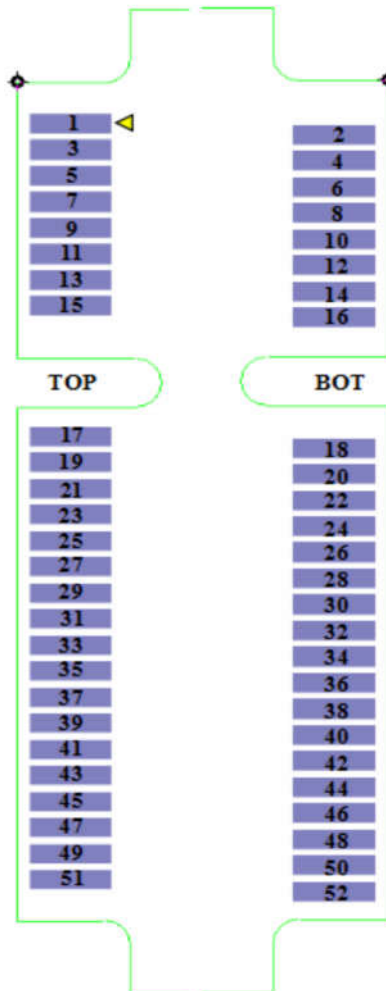


## 2 General Features

Parameter	Value
Main Chipset	GCT GDM7243ST Dual ARM1136JFS processor 400MHz
Memory	1Gb Nand Flash + 1Gb LPDDR2
Band support	Band 8/12/17/13/14/25/2/26/5/41/66/4/42/43/48
Antenna	3 UFL ports LTE: Main and auxiliary antenna GNSS antenna
Tx / Rx	1Tx / 2Rx
MIMO	DL: 4x2 MIMO or 2x2 MIMO UL: 1x2 MU-MIMO
Modulation	Uplink: QPSK / 16QAM / 64QAM Downlink: QPSK / 16QAM / 64QAM
Power output	+23dBm(Power Class 3)
Throughput	FDD DL: 150Mbps UL: 50Mbps
Interface	USB2.0 USIM1 / USIM2 GPIO
Voltage Input	3.0VDC ~ 3.6VDC ( Recommend 3.3V)
GNSS Output rating	0.3W with a voltage range of (3v -> 3.25v)
Operating Temperature	-40°C ~ +85°C ( Reduce RF performance: -40°C~ -30°C, +70°C~ +85°C
Storage Temperature	-40°C ~ +85°C

### 3 Pin Definitions

Pin Description	Pin No.
LTE_WAKE#	1
GPIO1	3
GPIO2	5
USIM2_RESET	7
GND	9
VREF_1V8	11
USIM2_PWR	13
GND	15
<b>TOP</b>	
USIM2_CLK	17
USIM2_DATA	19
GND	21
NC	23
NC	25
GND	27
GND	29
NC	31
NC	33
GND	35
GND	37
VCC_Main	39
VCC_Main	41
GND	43
NC	45
NC	47
NC	49
NC	51



Pin Description	Pin No.
VCC_Main	2
GND	4
NC	6
USIM1_PWR	8
USIM1_DATA	10
USIM1_CLK	12
USIM1_RESET	14
NC	16
<b>BOT</b>	
GND	18
W_DISABLE#	20
PERST#	22
VCC_Main	24
GND	26
NC	28
NC	30
NC	32
GND	34
USB_D-	36
USB_D+	38
GND	40
NC	42
GPIO3	44
NC	46
NC	48
GND	50
VCC_Main	52

Pin direction definition:

I: Carrier board to Module

O: Module to Carrier board

I/O: both direction among module and carrier board

PI: Power input

PO: Power output

Pin Name	Pin No.	Description	I/O	Voltage Domain
Power				
VCC_Main	2, 24,39, 41, 52	VCC source	PI	3.3V
VREF_1V8	11	1.8V output	PO	1.8V
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	Return current path		
Universal Serial Bus ( USB)				
USB_D+	38	USB serial data interface compliant to the USB 2.0 specification	I/O	
USB_D-	36		I/O	
Auxiliary Signals				
PERST#	22	Functional reset to the card	I	1.8V
LTE_WAKE#	1	Open Drain active Low signal. This signal is used to request that the system return from a sleep/suspended state to service a function initiated wake event.	O	
Communications Specific Signals				
W_DISABLE#	20	Active low signal. This signal is used by the system to disable radio operation on add-in cards that implement radio frequency applications. When implemented, this signal requires a pull-up resistor on the card.	I	
GPIO1	3			1.8V
GPIO2	5			1.8V
GPIO3	44			1.8V
User Identity Module ( UIM) Signals				
USIM1_PWR	8	Power source for the UIM. Compliant to the ISO/IEC 7816-3	O	1.8V/3V

		specification ( VCC )		
USIM1_RESET	14	UIM reset signal. Compliant to the ISO/IEC 7816-3 specification ( RST).	O	1.8V/3V
USIM1_CLK	12	UIM clock signal. Compliant to the ISO/IEC 7816-3 specification ( CLK).	O	1.8V/3V
USIM1_DATA	10	UIM data signal. Compliant to the ISO/IEC 7816-3 specification ( I/O).	I/O	1.8V/3V
USIM2_PWR	13	Power source for the UIM. Compliant to the ISO/IEC 7816-3 specification ( VCC )	O	1.8V/3V
USIM2_RESET	7	UIM reset signal. Compliant to the ISO/IEC 7816-3 specification ( RST).	O	1.8V/3V
USIM2_CLK	17	UIM clock signal. Compliant to the ISO/IEC 7816-3 specification ( CLK).	O	1.8V/3V
USIM2_DATA	19	UIM data signal. Compliant to the ISO/IEC 7816-3 specification ( I/O).	I/O	1.8V/3V
Others				
NC	6, 16, 23, 25, 28, 30, 31, 32, 33, 42, 45, 46, 47, 48, 49, 51	Should be floating		

## 4 DC Electrical

MG401 recommends the application condition as following table.

Parameter	Description	Minimum Value	Maximum Value	Unit
V <sub>IH</sub>	High-level input voltage	1.17	V <sub>DD_IO</sub>	V
V <sub>IL</sub>	Low-level input voltage	-0.3	0.63	V
V <sub>OH</sub>	high-level output voltage	1.6	V <sub>DD_IO</sub>	V
V <sub>OL</sub>	low-level output voltage	0	0.4	V

Pin Name	Pin No.	Pull-up
PERST#	22	Pull-up
W_DISABLE#	20	Pull-up

## 5 Power Consumption

## 6 RF Performance

Operating Band	Transmit Power (dBm)	Antenna Interface receiving sensitivity
Band 8	23±2	< -99dBm @10MHz bandwidth
Band 12/17	23±2	< -99dBm @10MHz bandwidth
Band 13	23±2	< -99dBm @10MHz bandwidth
Band 14	23±2	< -99dBm @10MHz bandwidth
Band 25/2	23±2	< -98dBm @10MHz bandwidth
Band 26/5	23±2	< -99dBm @10MHz bandwidth
Band 41	23±2	< -95dBm @20MHz bandwidth
Band 42/43/48	23±2	< -97dBm @20MHz bandwidth
Band 66/4	23±2	< -98dBm @10MHz bandwidth

## 7 Agency Certifications

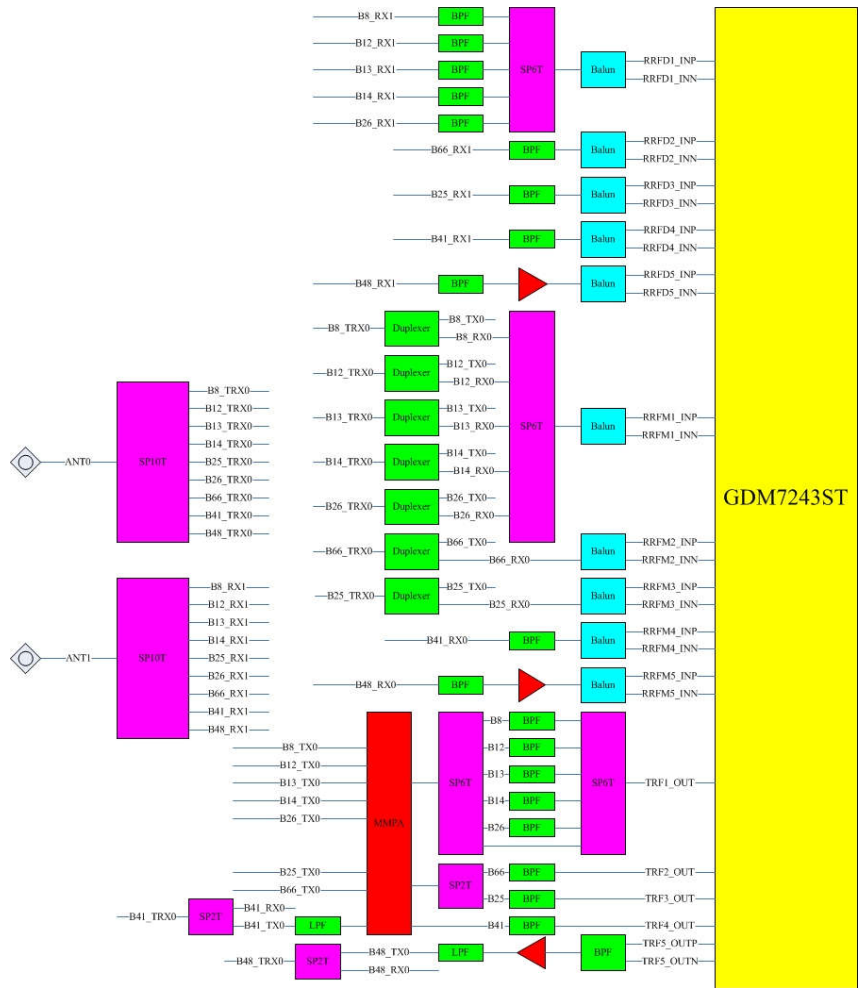
MG401 has been tested and certified with PTCRB/GCF/FCC/IC.

Test Specification
LTE FDD/TDD
3GPP TS 34.121 (RF/RRM-R8/R9)
3GPP TS 36.521-1 RF-R8
3GPP TS 36.521-1 RF-R9
3GPP TS 36.521-3 RRM-R8
3GPP TS 36.521-3 RRM-R9
3GPP TS 36.523-1 Protocol-R8
3GPP TS 36.523-1 Protocol-R9
3GPP TS 36.523-1 Protocol-(i-RAT)
ETSI EN 102 230 (UICC)
3GPP TS 31.121 USIM (R8)
3GPP TS 31.124 USAT (R8)
3GPP TS 26.132 (Acoustic) - Rel-12
3GPP TS 36.124 (LTE RSE eFDD) - PTCRB
3GPP TS 34.229-1 (IMS)
3GPP TS 37.571-1 (LTE A-GPS RF)
3GPP TS 37.571-2 (LTE A-GPS Protocol)
AE
AT Command (PTCRB)
LTE Data throughput (PTCRB)
GCF FT

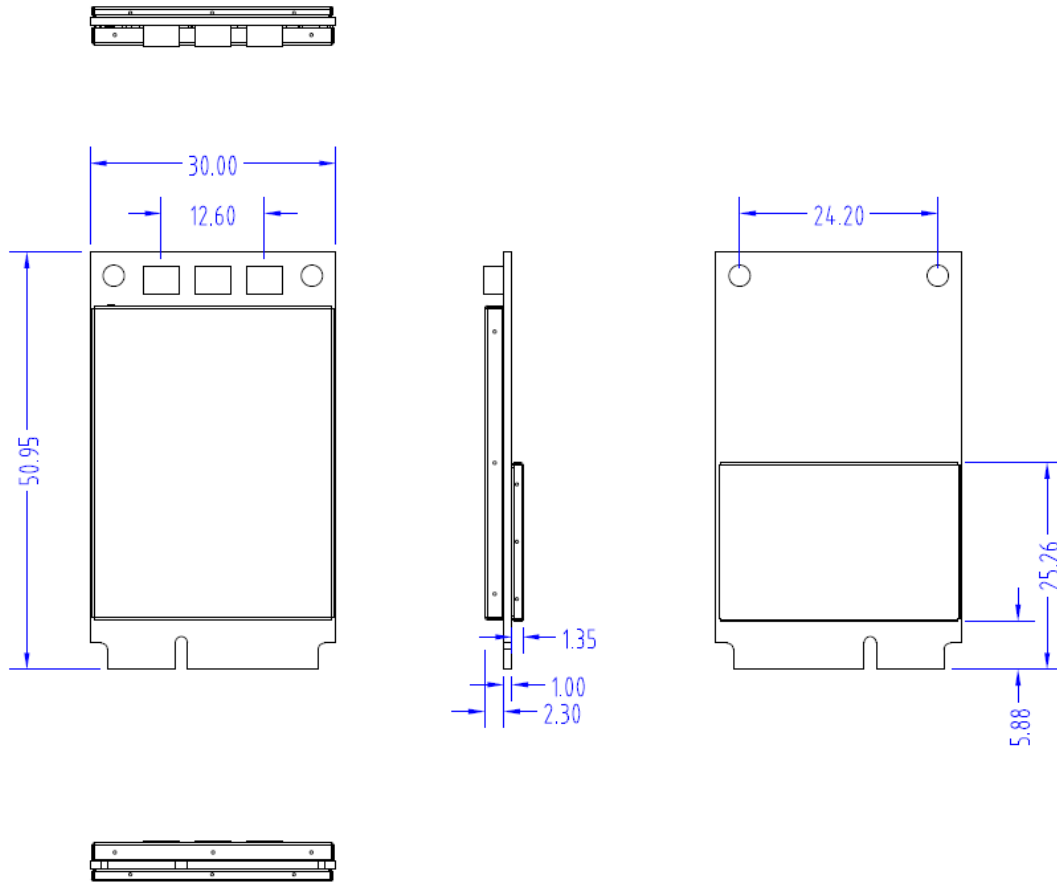
Country	Item	Standard
FCC	EMC	FCC Part 15B
	RF	FCC Part 22/24/27/90
		FCC Part 2.1093 MPE
Country	Item	Standard
IC	LTE	RSS-132/133/139/130/199/197
	SAR	RSS-102
	EMC	ICES-003

## 8 RF Block Diagram





## 9 Module Dimensions



### Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are compliant with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B

requirements if needed.

### **End Product Labeling**

When the module is installed in the host device, the FCC 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 re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: 2ASRY-MG401”

The FCC ID can be used only when all FCC compliance requirements are met.

### **Antenna Installation**

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

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

(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

In the event that these conditions cannot 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 cannot 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.

### **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.

### **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.

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.

### **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 20 cm between the radiator & your body.