

TEAM1-5GM MODEM/ROUTER

TM1-5GM2020SG

Complies with
IMDA Standards
DA108743

Overview

TeaM1-5GM is an industrial standard 5G modem to support 3G, 4G, 5G NR and GNSS. The robust mechanical enclosure design of modem/router makes it suitable to operate in harsh environment. Powered by 9 ~ 48V DC power supply, the device is suitable for vehicle, train, maritime, railway and outdoor applications



• Cellular network connection

TeaM1-5GM is able to provide connection between local devices and the internet through mobile 3G/4G/5G NR (Sub-6GHz) network supported by mobile ISP. The device is able to connect to a 5G NR Sub-6GHz network by default in either SA or NSA mode. In the case of the field that does not have 5G coverage from specific ISP or cellular network signal quality is not good enough to support essential data connection, the device will automatically fallback to 3G/4G connection. 5G network shall have the priority to be used when the device is within the area of co-existing 3G/4G/5G network coverage.

• Protocols and data security

Connection with Pre-configured multiple destination IP address in multiple protocol could be established upon powered on. Device authentication and data encryption using appropriate Transport Layer Security (TLS/SSL) cryptographic protocol will be implied between local device & remote site operating over the cellular network

Supported Frequency Band

1. 5G NR SA/NSA
 - n41/n77/n78/n79
2. 4G-LTE-FDD BANDS:
 - B1/B3/B5/B7/B8/B18/B19/B20/B28/B32
3. 4G-LTE-TDD BANDS:
 - B34/B38/B39/B40/B41/B42/ B43
4. GNSS
 - GPS/GLONASS/BeiDou/Galileo/QZSS(optional)

Support Features

- Firewall
- GNSS
- 4x MIMO
- Data logger
- Linux OS
- CPU AM5716
- UL: 200Mbps
- DL: 1.0Gbps
- TCP/UDP/FTP/HTTPs

1. Physical dimension and weight



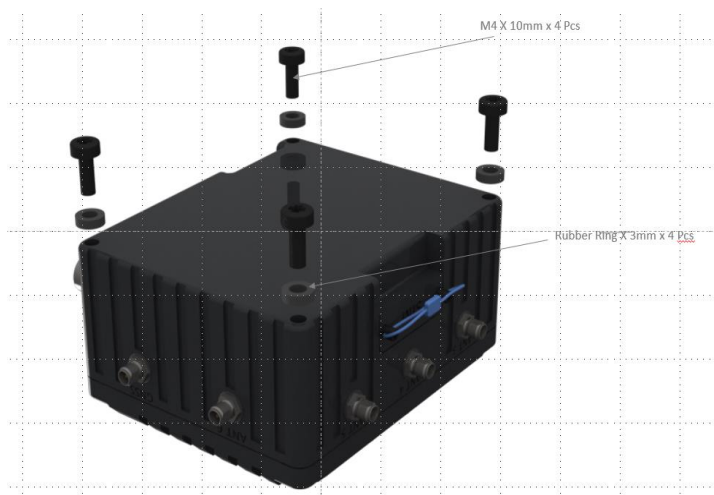
Mechanical Enclosure Features:

- Stealth design
- Size: 120mm x 97mm x 59mm.
- Weight: 600g
- Aluminum housing, AL6061
- Black anodizing

Specification

- Standard: DO-160F
- Ingress Protection: IP67
- Operating temperature: -40°C~70°C
- MTBF: 200,000 hours
- Vibration: 10g-PK random
- Shock: 20g impulse
- CE-RED
- RoHS3.0

2. Mounting holes



Connectors

- 1x Ethernet
- 1x USB 2.0 HS
- 2x RS232
- 1x RS485
- 1x RS422
- 4x Discrete Input
- 4x Discrete output
- 1x USB2.0 Engineering port



3. External Connectors

Connector	Part Number	Mating part	Description
J1	D38999/24WA35PN	D38999/26WA35SN	EMU_USB and power connection
J2	D38999/24WD35SN	D38999/24WD35PN	RS232/RS422/RS485/DIO port
J3	MRJR-8F81-01	MUSBR-AHD2-741SK	Ethernet port
J4	MUSBR-E151-30	MUSBR-AHD2-214SK	Panel connector for USB peripherals

4. SIM card insertion

- 1x Nano SIM slot
- A slot cover with rubber gasket sealing and screw by 2x M2x5mm screws for protection.

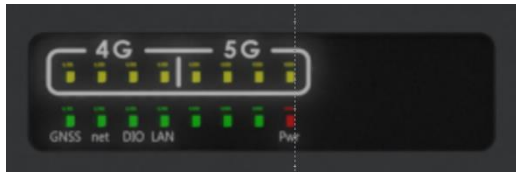
5. Data logger

- Cellular network RF information (RSSI, QoS, SNR etc.)
- Cellular network status
- GNSS time stamping with GNSS coordinates of longitude / latitude / altitude.
- Modem Status
- External device status
- Configuration / setting up of modem
- Able to be accessed from remote IP or locally

6. Engineering port

- USB2.0
- Setup of cellular network connection
- Setup of Discrete I/O
- Device diagnosis
- Device Configuration
- Logged data retrieving
- Device program update

7. LED indicators



Colour	LED_ID	Definition	Description	
Red	Power	Modem Power and Operating status	Solid ON	Power on no hardware fault
			Blink on 1s interval	Power on with hardware fault
			OFF	Power off
Blue	NET	Internet connection status	Solid ON	Internet connection established
			OFF	No Internet connection
Blue	Port	RS485/RS422/RS232 connectivity	Solid ON	RS485/RS422 plugged
			OFF	RS485/RS422 unplugged
Blue	USB	USB 2.0 port connection	Solid ON	USB cable plugged
			OFF	USB cable unplugged
Blue	DIO	DIO status	Solid ON	Digital I/O is working
			OFF	I/O is abnormal or stop working
Blue	GNSS	GNSS signal availability	Solid ON	GNSS location detected
			Blink on 1s interval	Searching for GNSS signal
			OFF	No GNSS signal or status error
Amber	4G	3G/4G signal strength(dBm) RSCP Weak: < -100 Medium: -80 ~ -100 Strong: > -80	Rotate blink	Searching for signal
			Solid ON (No data transaction)	3 x LED: Strong signal
				2 x LED: Medium signal
				1 x LED: Weak signal
				0 x LED: No signal
			Blink on 0.1s interval (Data transient ongoing)	3 x LED: Strong signal
				2 x LED: Medium signal
				1 x LED: Weak signal
0 x LED: No signal				
Amber	4G	3G/4G connectivity	Solid ON	Connected to 4G network
			OFF	4G network disconnected
Green	5G	5G connectivity	Solid ON	Connected to 5G network
			OFF	5G network disconnected
Green	5G	5G signal strength(dBm) RSCP Weak: < -100 Medium: -80 ~ -100 Strong: > -80	Rotate blink	Searching for signal
			Solid ON (No data transaction)	3 x LED: Strong signal
				2 x LED: Medium signal
				1 x LED: Weak signal
				0 x LED: No signal
			Blink on 0.1s interval (Data transient ongoing)	3 x LED: Strong signal
				2 x LED: Medium signal
				1 x LED: Weak signal
0 x LED: No signal				

Performances and Characteristics				
SN	Category	Characteristics		Remarks
1	Physical specifications			
1.1	Physical Size	< 120 x 97 x 59mm		
1.2	Weight	600g		
1.3	Mounting dimension	4 x M4x10 screw holes		
2	Electrical specifications			
2.1	Input Power supply	Operating voltage range	9V ~ 48V	DO-160F Max. 1.8A
		Peak Current rating	<1.5A @12VDC	
		Continuous current rating	<0.8A @ 12VDC	
2.2	Power supply Protection features	Reverse voltage	< -100VDC	
		Over voltage	DO-160F	
		Over current	Resettable fuse 6A	
		Monitoring	Voltage, current	
3	IO features and characteristics			
3.1	LEDs on panel UI	Power status	On / Off	Refer to Annex for detailed definition of LED illustration
		System status	Normal / Abnormal	
		Connectivity status	GNSS: connected/searching/failed Mode: 3G/4G/5G/no service Strength: high/normal/low IP connection Status: connected / disconnected.	
3.2	Discrete I/O	Input	9~36VDC/0V input	
		Output	0.25A@36VDC	
3.3	RS232	Baud rate	>115200bps	Able to be simulated as TCP ports
		Settings	Configurable	
		Flow control	Hardware / software	
3.4	RS422/RS482	Baud rate	>115200bps	Able to be simulated as TCP ports
		Data format	Configurable	
		Local address	Configurable	
3.5	Ethernet	Bandwidth	10/100/1000Mbps	
		Protocol Version	TCP, UDP, FTP, HTTP..... IPv4/IPv6	
		Standard	IEEE 802.3	
3.6	USB	Generation	USB2.0 HS / FS	
		Data rate	Not less than 200Mbps	

		Type	Device	HOST (option)
4	5GM RF network connectivity			
4.1	5G NR network	Supported region	EMEA/APAC	Data rate: dependent on actual field condition, Norm: DL < 1Gbps, UL<200Mbps Default: 5G NR SA/NSA TDD N78
		Operating mode	SA/NSA	
		NSA 5G EN-DC Combo	DC_1A_n38A, DC_20A_n38A DC_3A_n38A, DC_26A_n41A DC_3A_n41A, DC_39A_n41A DC_41A_n41A, DC_(n)41AA DC_8A_n41A, DC_1A_n28A DC_3A_n28A, DC_7A_n28A DC_20A_n28A, DC_3A_n1A DC_7A_n1A, DC_20A_n1A DC_8A_n1A, DC_1A_n7A DC_3A_n7A, DC_20A_n7A DC_28A_n7A, DC_1A_n40A DC_3A_n40A, DC_1A_n5A DC_3A_n5A, DC_1A_n3A DC_7A_n3A, DC_20A_n3A DC_8A_n3A, DC_28A_n3A DC_1A_n8A, DC_1A_n77A DC_18A_n77A, DC_28A_n77A DC_3A_77A, DC_41A_n77A DC_8A_n77A, DC_1A-42A_n77A DC_1A_n78A, DC_19A_n78A DC_20A_n78A, DC_28A_n78A DC_3A_n78A, DC_38A_n78A DC_40A_n78A, DC_5A_n78A DC_7A_n78A, DC_8A_n78A DC_1A-42A_n79A, DC_19A_n79A, DC_3A_n79A DC_39A_n79A, DC_41A_n79A	
		SA 5G Frequency Band	n41/n77/n78/n79	
		RF Sensitivity	Refer to RG500Q data sheet, RF receiving sensitivity -92dBm	
RF transmission power	Refer to RG500Q data sheet, RF transmission power, maximum at 26dBm			

		Data rate (up to)	NSA 5G NR DL 1.0Gbps; UL 200Mbps			
			SA 5G NR DL: 1.0Gbps; UL 200Mbps			
4.2	4G LTE network	Supported region	EMEA/APAC			
		Operating mode	LTE FDD/TDD (M1: B3/B7/B8 LTE, B1 UMTS)		Data rate: dependent on actual field condition, Norm: DL<500Mbps UL<150Mbps	
		Frequency Band	FDD	B1/B3/B5/B7/B8/B18/ B19/B20/B26/B28/B32		
			TDD	B34/B38/39/B40/B41 /B42/B43		
		RF Sensitivity	Refer to RG500Q data sheet, RF receiving sensitivity (-92.4dBm)			
		RF transmission power	Refer to RG500Q data sheet, RF transmission power class 2/3			
		Data rate (up to)	DL: 1.0Gbps, UL: 200Mbps			
4.3	3G network	DC, HSDPA etc.				
4.4	GNSS connectivity	Support	GPS, GLONASS, BeiDou/Compass, Galileo and QZSS		NEMA port available	
		Sensitivity	Cold start	-146dBm		
			Reacquisition	-157dBm		
			Tracking	-158dBm		
		TTFF	Cold start	35s		
			Warm start	28s		
			Hot start	1.3s		
Accuracy	CEP-50: 2.5m					
	Speed: TBD					
4.5	SMS	3G/4G/5G		TBD, on data security device safety.		





5	Data communication support		
5.1	Transparent data transaction	Between RS232, RS485/RS422 and remote IP terminals	
5.2	Smart data transaction (optional)	MODBUS over IP, LAN	
5.3	AT port for RG500Q control / configuration	Available from RS232, RS422/RS485, Ethernet, USB	
5.4	NEMA port for RG500Q GNSS configuration / information	Available from remote IP, local RS232, RS422/RS485, Ethernet, USB	
5.5	OTA port	Both for RG500Q and CPU (AM5716), from remote IP	
5.6	Local logged data access	Available from remote IP and all local ports (TBD)	
5.7	Local configuration and setup / status portal	Available from remote IP and all local ports (TBD) and SMS	
5.8	Multiple IP connection	Complied	Characteristics TBD
5.9	Multiple threads in individual connection	Complied	
5.10	4x MIMO antenna	Complied	
5.11	Mobile network connection priority	5G NR SA > 5G NR NSA > 4G > 3G, auto switch over	
5.12	Time to switch over from 4G to 5G network	TBD (condition and lagging time)	
5.13	Time to switch over from 5G to 4G network	TBD (Condition and lagging time)	
5.14	BER of RF communication	10E-9	
5.15	Delay time over cellular network	25ms for 4G LTE, 5ms for 5G (From each individual extension device to remote IP)	Dependent on network condition
5.16	Time to recover connection	<200ms	
6	Built-in test and failure detection / isolation / location functions		
6.1	BIT functions	Power supply malfunction detection.	BIT test result will be sent out through heart beat message and local panel LED will alert. The System shall operate
		System over-heat detection	
		Individual module malfunction detection	
		RAM fault detection	
		CPU loading detection	
		Network status / loading detection	

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		RS232 / RS422 communication malfunction detection	appropriately according to the fault detected.
		Discrete control signal malfunction detection	
		Input loss / failure detection	
7	System programmability, configuration, monitoring		
7.1	CPU (AM5716) program update	In-system programmable (for application software update only)	Through Ethernet and/or RS232
7.2	System debugging		
7.3	RG500Q Firmware update	In-system programmable or OTA from cellular network	Customization needed.
7.4	System monitoring	In-system real-time monitoring, BIT test result retrieve (sequential period prints out)	
7.5	System fault record	To record the fault found in system, could be retrieved.	
7.6	System configuration	RG500Q and AM5716 configuration, network setup, routing settings.	Through portal
8	Data security		
	Data safety	Data masking method / Data erasure	
8.1	Device authentication and data encryption	Provides authentication and data encryption between SOC/servers/UA operating over a cellular network (e.g. the UA client connects to the SOC through a server), using appropriate Transport Layer Security (TLS/SSL) cryptographic protocol	
8.2	Data interfaces to UA auto pilot	RS232, transparent data transaction	2xRS232, 2x RS422 Data terminal default baud rate 115200bps

Purchase list of TeaM1-5GM modem/router & accessories

1. Harsh Environment Package 1 (TeaM1-5GM-H1)

SN	Description	Quantity	Part No.	Photo	Remarks
1.1	TeaM1-5GM Modem/Router Unit	1	TM1-5GM2020SG		
1.2	Power cable	1	5GM-H1-B		Length 1m with open ended
1.3	IO cable (Serial ports, DIOs)	1	5GM-H2-B		Length 1m with open ended
1.4	Integrated 3G, 4G, 5G and GNSS antenna (IP69K)	1	5GM-ANT-M670-BB-6CG		Cable length 4.5m




2. Harsh Environment Package 2 (TeaM1-5GM-H2)

SN	Description	Quantity	Part No.	Photo	Remarks
2.1	TeaM1-5GM Modem/Router Unit	1	TM1-5GM2020SG		
2.2	Power cable	1	5GM-H1-B		Length 1m with open ended
2.3	IO cable (Serial ports, DIOs)	1	5GM-H2-B		Length 1m with open ended
2.4	Low-Profile integrated 3G, 4G, 5G and GNSS antenna (IP69K)	1	5GM-ANT-M970-BB-6CG		Cable length 4.5m

3. Basic Package (TeaM1-5GM-B)

SN	Description	Quantity	Part No.	Photo	Remarks
3.1	TeaM1-5GM Modem/Router Unit	1	TM1-5GM2020SG		
3.2	Power cable	1	5GM-H1-B		Length 1m with open ended
3.3	IO cable (Serial ports, DIOs)	1	5GM-H2-B		Length 1m with open ended
3.4	Integrated 3G, 4G, 5G antenna (IP67)	1	5GM-ANT-YB007AA		Cable length 0.5m
3.5	4G and 5G antenna (IP67)	2	5GM-ANT-GSA.8835		Cable length 1m

4. Optional & Customized Accessories

SN	Description	Part No.	Remark	
4.1	Power cable	5GM-H1-C-XX	XX: customization code issued. Customized length and/or termination available	
4.2	IO cable	5GM-H2-C-XX	XX: Customization code issued. Customized length and/or termination available	
4.3	IP67 Cat.5e/6 Ethernet cable	5GM-H3-C-XX		Options: Cable length with IP67 shielded cable and mounting.
4.4	IP67, USB2.0HS cable	5GM-H4-XX		Options: Cable length with IP67 shielded cable and mounting.
4.5	IP67 GNSS active antenna	5GM-ANT - GNSS - YLY001CA		Cable length 1m and SMA terminal

Please contact supplier for customization of functions and accessories

Appendix

1. 5GM-ANT- M670-BB-6CG



- All in one 6+1 MIMO Cellular 4G/5G + GNSS/GPS
- Antenna Cellular Frequency 600 to 6000MHz
- GNSS Frequency Range 1562-1612MHz
- 50Ω Nominal Impedance
- Operation Temperature -40 to 80 °C
- IP69K Water Ingress Protection
- High Impact UV Stable ABS Polymer Antenna Housing
- Antenna Housing Height: 114mm (4.5") / Base Diameter: 140mm (5.5")

2. 5GM-ANT- M970-BB-6CG



- All in one 6+1 MIMO Cellular 4G/5G + GNSS/GPS
- Antenna Cellular Frequency 600 to 6000MHz
- GNSS Frequency Range 1562-1612MHz
- 50Ω Nominal Impedance
- Operation Temperature -40 to 80 °C
- IP69K Water Ingress Protection
- High Impact UV Stable ABS Polymer Antenna Housing
- Antenna Housing Height: 65mm (2.56") / Base Length: 200mm (7.87") / Base Width: 60mm (2.36")

3. 5GM-ANT- YB0007AA



- 4x MIMO Cellular 4G/5G
- Antenna Cellular Frequency 600 to 5000MHz
- 50Ω Nominal Impedance
- Operation Temperature -20 to 80 °C
- IP67 Water Ingress Protection
- KIBILAC® ASA material of Antenna Housing/shell
- Antenna Housing Height: 43mm / Base Diameter: 120mm

4. 5GM-ANT- GSA.8835



- Cellular 4G/5G
- Antenna Cellular Frequency 600 to 6000MHz
- 50Ω Nominal Impedance
- Operation Temperature -40 to 85 °C
- IP67 Water Ingress Protection
- PC+ABS Antenna Housing
- Antenna Housing Height: 7.9mm / Base Length: 105mm / Base Width: 30mm