

Product Reference Manual
SKU: TPX00200-TPX00201



Description

Start benefit of the fast data throughput and high bandwidths of the Arduino Pro 4G Module. Developed in the widely adopted Mini PCIe form factor, the Pro 4G Module leverages a powerful LTE Cat 4 modem from Quectel® to guarantee reliable 4G connectivity and backward compatibility with existing 2G and 3G networks. Available in two variants, EMEA (Europe, Middle East, and Africa) and Global (including the United States), the Pro 4G Module module can be combined with multiple Portenta family boards to develop endless applications in several scenarios, such as smart cities, smart buildings, vending machines, remote maintenance, and fleet management applications.

Target Areas

Remote maintenance, fleet management, pipeline monitoring, smart cities, smart buildings, smart parking, and waste management

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1 Application Examples

The Arduino Pro 4G Module, with its advanced LTE capabilities and GNSS functionality (Global variant only), opens the door to various innovative applications across different sectors. Beyond its core feature of providing robust cellular connectivity, this module facilitates deploying solutions in urban and industrial environments where reliability and precision are paramount. Whether for real-time monitoring, asset tracking, or enhancing operational efficiencies, the Pro 4G Module is a versatile foundation for IoT development. Here are some practical examples showcasing the module's potential to transform various applications:

- **Remote maintenance:** Connect to all your Portenta-based machines remotely and guarantee on-time support with the Pro 4G Module, regardless of location. Perform error analysis directly from your office, leveraging a reliable 4G connection and updating the firmware of your products thanks to the Arduino Cloud compatibility.
- **Fleet management:** Start tracking all your vehicle's location, movement history, and geofencing by integrating the Pro 4G GNSS Module. Calculate run hours and traveled distance to understand and optimize heavy equipment and vehicle utilization.
- **Pipeline monitoring:** Detect leaks, ensure accurate gas flow measurement, and predict the behavior of your pipeline without the need for other network infrastructure by simply combining a Portenta family board with the Pro 4G GNSS Module.
- **Smart cities:** The Pro 4G Module can be used in different smart cities applications such as:
 - **Smart lighting:** Integrate the Pro 4G Module into the urban light system to properly balance lighting and optimize energy consumption.
 - **Smart city security:** By adding the Pro 4G Module to CCTV infrastructures, cities become more secure. Leverage machine vision and 4G to detect thieves, vandalism, or street accidents even in areas out of Wi-Fi® range and notify the police in time.
 - **Smart parking:** Combine a Portenta family board with a Pro 4G GNSS Module to map parking lot occupancy. In this way drivers may check in advance for free slots, reducing overall traffic jams and improving environmental conditions.
 - **Waste management:** Deploy a Portenta family board with the Pro 4G GNSS Module into waste bins to establish the level of filling and report anomalies so that recycling rate, collection timing, and waste volume are improved.
- **Smart buildings:** The Pro 4G Module can be used in different smart building applications such as:
 - **Smart vending machines:** Let your customers purchase what they need, when and where they need it, by integrating the Pro 4G GNSS Module into your vending machine or smart kiosk. Install your vending machine without location constraints and monitor its usage and performance remotely.
 - **Building safety inspection:** Even in remote areas, combine a Portenta family board with the Pro 4G Module to allow building owners or inspectors to remotely control deformation, temperature, moisture level, and other buildings' chemical, mechanical and physical parameters.
 - **Smart building security:** Leverage the integrated 4G connectivity of the Pro 4G Module to build your own Wi-Fi® independent alarm infrastructures. Monitor gas leakages, fires and glass breaking from anywhere and receive on-time SMS notifications in case of unauthorized entrances.

2 Features

2.1 Module Description

Adding 4G connectivity to the Portenta family opens up new possibilities for reliable data communication, especially in remote areas. This feature ensures devices can maintain strong indoor and outdoor signal coverage, making it versatile for a wide range of applications. Significantly, it simplifies global deployment across various countries without necessitating changes to the board itself, thereby reducing infrastructure costs compared to traditional connectivity solutions. The Mini PCIe form factor facilitates easy integration and broad compatibility while offering capabilities like SMS alerts for real-time notification in critical situations. This enhancement broadens the scope for innovative projects and streamlines the development and deployment process.

The supported frequency bands, and digital audio functions of the EMEA variant (SKU: TPX00201) of the Pro 4G Module are shown in the table below.

Feature	Description
Variant	EMEA (SKU: TPX00201)
Modem	Quectel® EC200A
LTE-FDD	B1/B3/B5/B7/B8/B20/B28
LTE-TDD	B38/B40/B41
WCDMA	B1/B5/B8
GSM	EGSM900/DCS1800
Digital Audio (PCM)	Supported

The supported frequency bands, GNSS, and digital audio functions of the Global variant (SKU: TPX00200) of the Pro 4G Module are shown in the table below.

Feature	Description
Variant	Global (SKU: TPX00200)
Modem	Quectel® EG25-G
LTE-FDD	B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28
LTE-TDD	B38/B39/B40/B41
WCDMA	B1/B2/B4/B5/B6/B8/B19
GSM	850/900/1800/1900
GNSS (Optional)	GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS
Digital Audio (PCM)	Supported

Note: Both Pro 4G Module variants are compatible with the Arduino Portenta Mid Carrier and can work with any Portenta Family board. The Arduino Portenta Max Carrier is compatible with both Pro 4G Module variants but only with the Portenta X8 board.

2.2 Key Features

The main features of the Pro 4G Module, both variants, are summarized and highlighted in the table below.

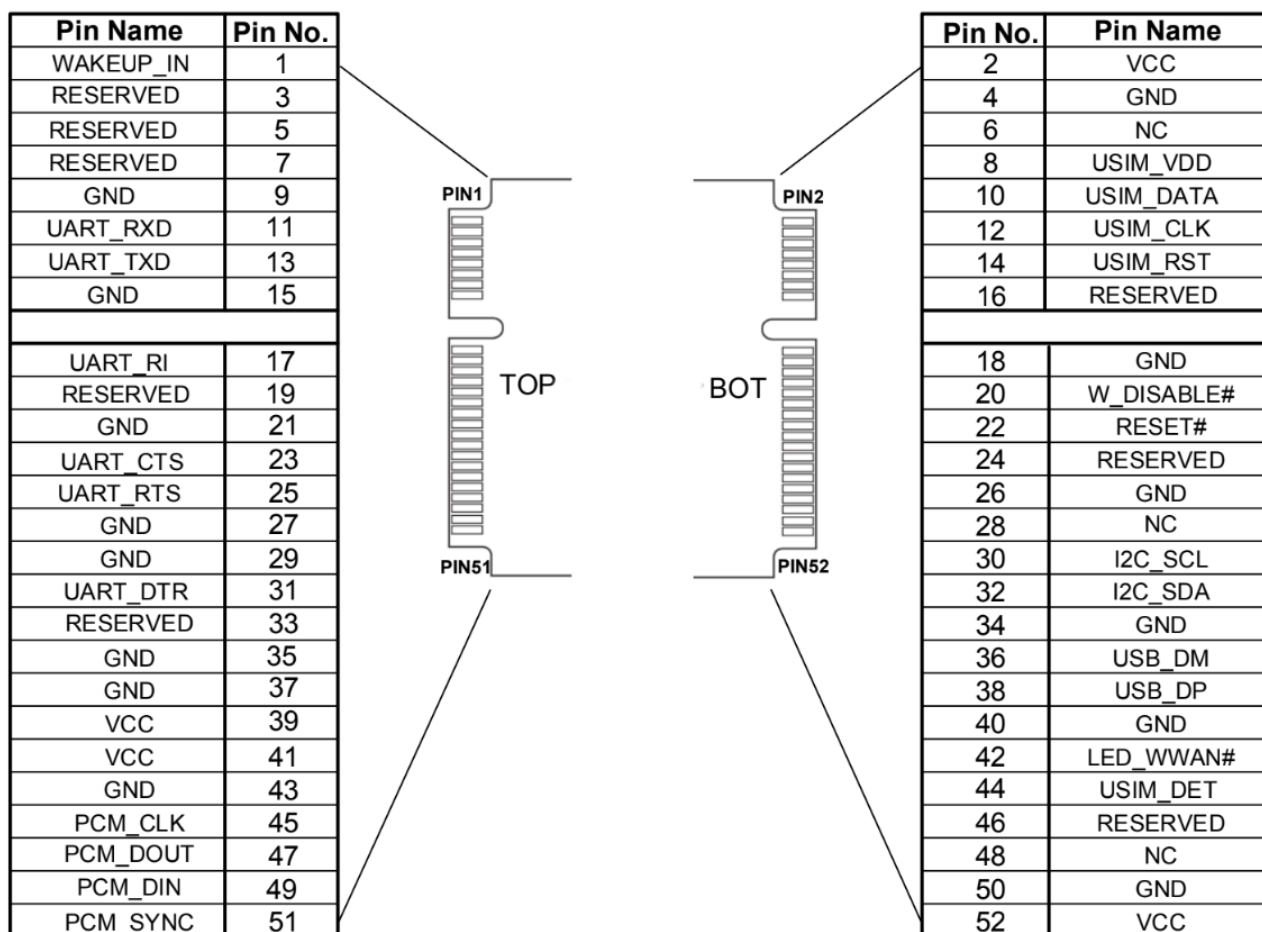
Feature	Details
Modem	EMEA (SKU: TPX00201): Quectel® EC200A Global (SKU: TPX00200): Quectel® EG25-G
Function Interface	PCI Express Mini Card 1.2 Standard Interface
Power Supply	- Supply voltage: 3.0–3.6 VDC - Typical supply voltage: 3.3 VDC
Transmitting Power	- Class 4 (33 dBm $\pm$ 2 dB) for GSM850 - Class 4 (33 dBm $\pm$ 2 dB) for EGSM900 - Class 1 (30 dBm $\pm$ 2 dB) for DCS1800 - Class 1 (30 dBm $\pm$ 2 dB) for PCS1900 - Class E2 (27 dBm $\pm$ 3 dB) for GSM850 8-PSK - Class E2 (27 dBm $\pm$ 3 dB) for EGSM900 8-PSK - Class E2 (26 dBm $\pm$ 3 dB) for DCS1800 8-PSK - Class E2 (26 dBm $\pm$ 3 dB) for PCS1900 8-PSK - Class 3 (24 dBm $\pm$ 1/-3 dB) for WCDMA bands - Class 3 (23 dBm $\pm$ 2 dB) for LTE-FDD bands - Class 3 (23 dBm $\pm$ 2 dB) for LTE-TDD bands
LTE Features	- Supports up to non-CA Cat 4 FDD and TDD - Supports 1.4/3/5/10/15/20 MHz RF bandwidth - Supports MIMO in DL direction - Max. transmission data rates: LTE-FDD: 150 Mbps (DL), 50 Mbps (UL) LTE-TDD: 130 Mbps (DL), 30 Mbps (UL)
UMTS Features	- Supports 3GPP Rel-8 DC-HSDPA, HSPA+, HSDPA, HSUPA, and WCDMA - Supports QPSK, 16QAM and 64QAM modulation - Max. transmission data rates: DC-HSDPA: 42 Mbps (DL) HSUPA: 5.76 Mbps (UL) WCDMA: 384 kbps (DL), 384 kbps (UL)
GSM Features	- GPRS: Supports GPRS multi-slot class 33 (33 by default), Coding scheme: CS-1, CS-2, CS-3 and CS-4, Max. 107 kbps (DL), Max. 85.6 kbps (UL) - EDGE: Supports EDGE multi-slot class 33 (33 by default), Supports GMSK and 8-PSK for different MCS (Modulation and Coding Scheme), Downlink coding schemes: MCS 1-9, Uplink coding schemes: MCS 1-9, Max. 296 kbps (DL), Max. 236.8 kbps (UL)
Internet Protocol Features	Supports TCP/UDP/PPP/FTP/FTPS/HTTP/HTTPS/NTP/PING/QMI/NITZ/SMTP/SSL/MQTT/CMUX/SMTPS/FILE/MMS protocols, Supports PAP and CHAP for PPP connections
SMS	- Text and PDU modes - Point-to-point MO and MT - SMS cell broadcast - SMS storage: ME by default
(U)SIM Interface	Supports USIM/SIM card: 1.8 V, 3.0 V
UART Interface	- Main UART: Supports RTS and CTS hardware flow control - Baud rate can reach up to 230400 bps, 115200 bps by default

Feature	Details
	- Used for AT command communication and data transmission
Audio Features	- Supports one digital audio interface: PCM interface - GSM: HR/FR/EFR/AMR/AMR-WB - WCDMA: AMR/AMR-WB - LTE: AMR/AMR-WB - Supports echo cancellation and noise suppression
PCM Interface	- Supports 16-bit linear data format - Supports long frame synchronization and short frame synchronization - Supports master and slave modes, but must be the master for long frame synchronization
USB Interface	- Compliant with USB 2.0 specification (slave only); the data transfer rate can reach up to 480 Mbps - Used for AT command communication, data transmission, firmware upgrade, software debugging and GNSS NMEA output - Supports USB serial drivers for: Windows 7/8/8.1/10, Linux 2.6–5.12, Android 4.x–11.x, etc.
Antenna Connectors	Includes main antenna, diversity antenna, and GNSS antenna receptacle connectors
Rx-diversity (Optional)	Supports LTE/WCDMA Rx-diversity
GNSS (Global variant only)	GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS

3 Functional Overview

3.1 Pinout

The following figure shows the top and bottom pinout of the Arduino Pro 4G Module for both variants.



3.2 Full Pinout

The following tables show the full pinout of the Pro 4G Module, beginning with the definition and description of the 52 pins.

3.2.1 I/O Parameters Definition

Pin Type	Description
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
OC	Open Collector
OD	Open Drain
PI	Power Input
PO	Power Output

3.2.2 Pin Description

Pin Number	Mini PCI Express Standard Pin Name	Pro 4G Module Mini PCIe Pin Name	Pin Type	Description	Details
1	WAKE#	WAKE#	OC	Wake up the host	
2	3.3Vaux	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	It is prohibited to be pulled up to high level before startup.
3	COEX1	RESERVED		Reserved	
4	GND	GND		Mini card ground	
5	COEX2	RESERVED		Reserved	It is prohibited to be pulled up to high level before startup.
6	1.5V	NC		Not connected	
7	CLKREQ#	RESERVED		Reserved	
8	UIM_PWR	USIM_VDD	PO	(U)SIM card power supply	
9	GND	GND		Mini card ground	
10	UIM_DATA	USIM_DATA	DIO	(U)SIM card data	
11	REFCLK-	UART_RX	DI	UART receive	Connect to DTE's Tx.
12	UIM_CLK	USIM_CLK	DO	(U)SIM card clock	
13	REFCLK+	UART_TX	DO	UART transmit	Connect to DTE's Rx.
14	UIM_RESET	USIM_RST	DO	(U)SIM card reset	
15	GND	GND		Mini card ground	
16	UIM_VPP	RESERVED		Reserved	
17	RESERVED	RI	DO	Ring indication	
18	GND	GND		Mini card ground	
19	RESERVED	RESERVED		Reserved	

Pin Number	Mini PCI Express Standard Pin Name	Pro 4G Module Mini PCIe Pin Name	Pin Type	Description	Details
20	W_DISABLE#	W_DISABLE#	DI	Airplane mode control	Pulled up by default. Active LOW.
21	GND	GND		Mini card ground	
22	PERST#	PERST#	DI	Fundamental reset	Pulled up by default. Active LOW.
23	PERnO	UART_CTS	DI	DCE clear to send signal from DTE	Connects to DTE's RTS.
24	3.3Vaux	RESERVED		Reserved	
25	PERpO	UART_RTS	DO	DCE request to send signal from DTE	Connects to DTE's CTS.
26	GND	GND		Mini card ground	
27	GND	GND		Mini card ground	
28	1.5V	NC		Not connected	
29	GND	GND		Mini card ground	
30	SMB_CLK	I2C_SCL	DO	I2C serial clock (for external Codec)	Requires external pull-up to 1.8 V.
31	PETnO	DTR	DI	Sleep mode control	
32	SMB_DATA	I2C_SDA	DIO	I2C serial data (for external Codec)	Requires external pull-up to 1.8 V.
33	PETpO	RESERVED		Reserved	
34	GND	GND		Mini card ground	
35	GND	GND		Mini card ground	
36	USB_D-	USB_DM	AIO	USB differential data (-)	Requires differential impedance of 90 Ω.
37	GND	GND		Mini card ground	
38	USB_D+	USB_DP	AIO	USB differential data (+)	Requires differential impedance of 90 Ω.
39	3.3Vaux	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	
40	GND	GND		Mini card ground	
41	3.3Vaux	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	
42	LED_WWAN#	LED_WWAN#	OC	LED signal for indicating the network status of the module	Active LOW.
43	GND	GND		Mini card ground	
44	LED_WLAN#	USIM_PRESENCE	DI	(U)SIM card hot-plug detect	
45	RESERVED	PCM_CLK	DIO	PCM clock	
46	LED_WPAN#	RESERVED		Reserved	
47	RESERVED	PCM_DOUT	DO	PCM data output	
48	1.5V	NC		Not connected	
49	RESERVED	PCM_DIN	DI	PCM data input	
50	GND	GND		Mini card ground	

Pin Number	Mini PCI Express Standard Pin Name	Pro 4G Module Mini PCIe Pin Name	Pin Type	Description	Details
51	RESERVED	PCM_SYNC	DIO	PCM frame sync	
52	3.3Vaux	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	

3.3 GNSS (Only for Global Variant)

The Arduino Pro 4G Module Global variant (SKU: TPX00200) includes a fully integrated global navigation satellite system solution that supports GPS, GLONASS, BeiDou (COMPASS), Galileo and QZSS. Additionally, it supports standard NMEA 0183 protocol, and outputs NMEA sentences at 1 Hz data update rate via USB interface by default. By default, the GNSS engine of the module is switched off and can only be switched on via the dedicated Arduino library.

3.3.1 GNSS Performance and Frequency

The following table shows the GNSS performance of the Pro 4G Module Global variant (SKU: TPX00200).

Parameter	Description	Conditions	Typical	Unit
Sensitivity (GNSS)	Cold start	Autonomous	-146	dBm
	Reacquisition	Autonomous	-156	dBm
	Tracking	Autonomous	-157	dBm
TTFF(GNSS)	Cold start @ open sky	Autonomous	35	s
		XTRA enabled	15	s
	Warm start @ open sky	Autonomous	28	s
		XTRA enabled	3	s
	Hot start @ open sky	Autonomous	2	s
		XTRA enabled	1.6	s
Accuracy (GNSS)	CEP-50	Autonomous @ open sky	< 2.5	m

The following table shows the GNSS frequency of the Pro 4G Module Global variant.

Type	Frequency	Unit
GPS	1575.42 ±1.023	MHz
GLONASS	1597.5–1605.8	MHz
Galileo	1575.42 ±2.046	MHz
BeiDou (COMPASS)	1561.098 ±2.046	MHz
QZSS	1575.42	MHz

4 Ratings

4.1 Power Supply Requirements

Below is a table summarizing the power supply requirements and digital I/O characteristics for the Arduino Pro 4G Module, both variants, outlining the key electrical parameters critical for integrating and operating the module effectively.

Parameter	Description	Min	Typ	Max	Unit
Power Supply					
VCC	Power supply for the module	3.0	3.3	3.6	V
Digital I/O Characteristics					
VIH	Input High Voltage	$0.7 \times VCC$		$VCC + 0.3$	V
VIL	Input Low Voltage	-0.3		$0.3 \times VCC$	V
VOH	Output High Voltage		$VCC - 0.5$	VCC	V
VOL	Output Low Voltage	0		0.4	V

4.2 TX Power

The following table show the conducted Tx power of the Pro 4G Module EMEA variant (SKU: TPX00201).

Frequency Bands	Maximum Tx power	Minimum Tx Power
GSM850	33 dBm ± 2 dB	5 dBm ± 5 dB
EGSM900	33 dBm ± 2 dB	5 dBm ± 5 dB
DCS1800	30 dBm ± 2 dB	0 dBm ± 5 dB
PCS1900	30 dBm ± 2 dB	0 dBm ± 5 dB
GSM850 (8-PSK)	27 dBm ± 3 dB	5 dBm ± 5 dB
EGSM900 (8-PSK)	27 dBm ± 3 dB	5 dBm ± 5 dB
DCS1800 (8-PSK)	26 dBm ± 3 dB	0 dBm ± 5 dB
PCS1900 (8-PSK)	26 dBm ± 3 dB	0 dBm ± 5 dB
WCDMA B1/B2/B4/B5/B8	24 dBm $+1/-3$ dB	< -49 dBm
LTE-FDD B1/B2/B3/B4/B5/B7/B8/B20/B28/B66	23 dBm ± 2 dB	< -39 dBm
LTE-TDD B34/B38/B39/B40/B41	23 dBm ± 2 dB	< -39 dBm

The following table show the Rx sensitivity of the Pro 4G Module EMEA variant (SKU: TPX00201).

Frequency Bands	Primary	Diversity	SIMO 4	3GPP (SIMO)
EGSM900	-108.7 dBm	-	-	-102.0 dBm
DCS1800	-107 dBm	-	-	-102.0 dBm
WCDMA B1	-109.7 dBm	-	-	-106.7 dBm
WCDMA B5	-110.6 dBm	-	-	-104.7 dBm
WCDMA B8	-110.3 dBm	-	-	-103.7 dBm
LTE-FDD B1 (10 MHz)	-96.9 dBm	-97 dBm	-100.8 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-95.9 dBm	-96.8 dBm	-100.4 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.3 dBm	-99 dBm	-102.2 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-94.4 dBm	-95.8 dBm	-98 dBm	-94.3 dBm

Frequency Bands	Primary	Diversity	SIMO 4	3GPP (SIMO)
LTE-FDD B8 (10 MHz)	-96.7 dBm	-98.9 dBm	-100.1 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-98.1 dBm	-99.3 dBm	-101.4 dBm	-93.3 dBm
LTE-FDD B28 (10 MHz)	-98.9 dBm	-99.5 dBm	-102.6 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-96.5 dBm	-95.2 dBm	-99.3 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-97.3 dBm	-97.3 dBm	-100.5 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-94.9 dBm	-95.1 dBm	-97.8 dBm	-94.3 dBm

The following table show the conducted Tx power of the Pro 4G Module Global variant (SKU: TPX00200).

Frequency Bands	Maximum RF Output Power	Minimum RF Output Power
GSM850/EGSM900	33 dBm $\pm$ 2 dB	5 dBm $\pm$ 5 dB
DCS1800/PCS1900	30 dBm $\pm$ 2 dB	0 dBm $\pm$ 5 dB
GSM850/EGSM900 (8-PSK)	27 dBm $\pm$ 3 dB	5 dBm $\pm$ 5 dB
DCS1800/PCS1900 (8-PSK)	26 dBm $\pm$ 3 dB	0 dBm $\pm$ 5 dB
WCDMA bands	24 dBm $\pm$ 1/-3 dB	< -49 dBm
LTE-FDD bands	23 dBm $\pm$ 2 dB	< -39 dBm
LTE-TDD bands	23 dBm $\pm$ 2 dB	< -39 dBm

The following table show the Rx sensitivity of the Pro 4G Module EMEA variant (SKU: TPX00201).

Frequency Bands	Primary	Diversity	SIMO 3	3GPP (SIMO)
GSM850	-108 dBm	-	-	-102 dBm
EGSM900	-108 dBm	-	-	-102 dBm
DCS1800	-107.5 dBm	-	-	-102 dBm
PCS1900	-107.5 dBm	-	-	-102 dBm
WCDMA B1	-108.2 dBm	-108.5 dBm	-109.2 dBm	-106.7 dBm
WCDMA B2	-109.5 dBm	-109 dBm	-110 dBm	-104.7 dBm
WCDMA B4	-109.5 dBm	-	-	-103.7 dBm
WCDMA B5	-109 dBm	-109.5 dBm	-110 dBm	-104.7 dBm
WCDMA B6	-109 dBm	-109.5 dBm	-110.5 dBm	-106.7 dBm
WCDMA B8	-109.2 dBm	-	-	-103.7 dBm
WCDMA B19	-109 dBm	-109.5 dBm	-110.5 dBm	-106.7 dBm
LTE-FDD B1 (10 MHz)	-97.3 dBm	-98.3 dBm	-99.5 dBm	-96.3 dBm
LTE-FDD B2 (10 MHz)	-98 dBm	-99 dBm	-99.9 dBm	-94.3 dBm
LTE-FDD B3 (10 MHz)	-97.4 dBm	-98.1 dBm	-99.8 dBm	-93.3 dBm
LTE-FDD B4 (10 MHz)	-97.7 dBm	-98.2 dBm	-99.7 dBm	-96.3 dBm
LTE-TDD B5 (10 MHz)	-98 dBm	-98.5 dBm	-99.9 dBm	-94.3 dBm
LTE-TDD B7 (10 MHz)	-97.3 dBm	-97.3 dBm	-99.1 dBm	-94.3 dBm
LTE-TDD B8 (10 MHz)	-98 dBm	-98.1 dBm	-99.8 dBm	-93.3 dBm
LTE-TDD B12 (10 MHz)	-98 dBm	-98.1 dBm	-99.9 dBm	-93.3 dBm
LTE-TDD B13 (10 MHz)	-98 dBm	-98.1 dBm	-100.1 dBm	-93.3 dBm
LTE-TDD B18 (10 MHz)	-98 dBm	-99.5 dBm	-100 dBm	-96.3 dBm
LTE-TDD B19 (10 MHz)	-98 dBm	-99 dBm	-99.8 dBm	-96.3 dBm
LTE-TDD B20 (10 MHz)	-98 dBm	-98.8 dBm	-99.7 dBm	-93.3 dBm
LTE-TDD B25 (10 MHz)	-98 dBm	-98 dBm	-100.2 dBm	-92.8 dBm

Frequency Bands	Primary	Diversity	SIMO 3	3GPP (SIMO)
LTE-TDD B26 (10 MHz)	-98 dBm	-98.8 dBm	-100 dBm	-93.8 dBm
LTE-TDD B28 (10 MHz)	-98.1 dBm	-98.9 dBm	-99.8 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-96.8 dBm	-96.9 dBm	-98.3 dBm	-96.3 dBm
LTE-TDD B39 (10 MHz)	-98 dBm	-98.2 dBm	-99.8 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-97.7 dBm	-97.5 dBm	-99.7 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-96.8 dBm	-96.0 dBm	-98 dBm	-94.3 dBm

4.3 ESD Characteristics

If the static electricity generated by various ways discharges to the module, the module maybe damaged to a certain extent. Thus, please take proper ESD countermeasures and handling methods.

The following table shows the ESD characteristics of the Pro 4G Module, both variants.

Tested Interfaces	Contact Discharge	Air Discharge	Unit
Power Supply and GND	±5	±10	kV
Antenna Interfaces	±4	±8	kV
USB Interface	±4	±8	kV
(U)SIM Interface	±4	±8	kV
Others	±0.5	±1	kV

4.4 Power Consumption

The following table show the power consumption of the Pro 4G Module EMEA variant (SKU: TPX00201).

Conditions	Typ	Unit
Sleep Mode		
AT+CFUN=0 (USB disconnected)	3.25	mA
EGSM900 @ DRX = 2 (USB disconnected)	5.59	mA
EGSM900 @ DRX = 5 (USB disconnected)	4.26	mA
EGSM900 @ DRX = 5 (USB suspend)	4.58	mA
EGSM900 @ DRX = 9 (USB disconnected)	3.99	mA
DCS1800 @ DRX = 2 (USB disconnected)	5.71	mA
DCS1800 @ DRX = 5 (USB disconnected)	4.24	mA
DCS1800 @ DRX = 5 (USB suspend)	4.64	mA
DCS1800 @ DRX = 9 (USB disconnected)	3.73	mA
WCDMA @ PF = 64 (USB disconnected)	5.94	mA
WCDMA @ PF = 64 (USB suspend)	6.15	mA
WCDMA @ PF = 128 (USB disconnected)	4.45	mA
WCDMA @ PF = 256 (USB disconnected)	3.72	mA
WCDMA @ PF = 512 (USB disconnected)	3.45	mA
LTE-FDD @ PF = 32 (USB disconnected)	7.29	mA
LTE-FDD @ PF = 64 (USB disconnected)	5.94	mA
LTE-FDD @ PF = 64 (USB suspend)	6.12	mA
LTE-FDD @ PF = 128 (USB disconnected)	4.71	mA
LTE-FDD @ PF = 256 (USB disconnected)	4.24	mA

Conditions	Typ	Unit
Idle Mode		
EGSM900 DRX = 5 (USB disconnected)	48.69	mA
EGSM900 DRX = 5 (USB connected)	73.96	mA
WCDMA @ PF = 64 (USB disconnected)	54.88	mA
WCDMA @ PF = 64 (USB connected)	74.74	mA
LTE-FDD @ PF = 64 (USB disconnected)	52.94	mA
LTE-FDD @ PF = 64 (USB connected)	73.83	mA
LTE-TDD @ PF = 64 (USB disconnected)	51.45	mA
LTE-TDD @ PF = 64 (USB connected)	74.27	mA
GPRS Data Transfer		
EGSM900 4DL/1UL @ 33.01 dBm	199	mA
EGSM900 3DL/2UL @ 32.93 dBm	372	mA
EGSM900 2DL/3UL @ 30.91 dBm	478	mA
EGSM900 1DL/4UL @ 28.95 dBm	533	mA
DCS1800 4DL/1UL @ 29.74 dBm	136	mA
DCS1800 3DL/2UL @ 29.82 dBm	244	mA
DCS1800 2DL/3UL @ 28.35 dBm	293	mA
DCS1800 1DL/4UL @ 26.35 dBm	309	mA
EDGE Data Transfer		
EGSM900 4DL/1UL @ 26.09 dBm	137	mA
EGSM900 3DL/2UL @ 25.45 dBm	246	mA
EGSM900 2DL/3UL @ 23.43 dBm	315	mA
EGSM900 1DL/4UL @ 20.82 dBm	375	mA
DCS1800 4DL/1UL @ 26.53 dBm	121	mA
DCS1800 3DL/2UL @ 26.27 dBm	215	mA
DCS1800 2DL/3UL @ 24.69 dBm	289	mA
DCS1800 1DL/4UL @ 22.00 dBm	360	mA
WCDMA Data Transfer		
WCDMA B1 HSDPA @ 23.63 dBm	520	mA
WCDMA B1 HSUPA @ 22.45 dBm	474	mA
WCDMA B5 HSDPA @ 23.08 dBm	496	mA
WCDMA B5 HSUPA @ 21.56 dBm	504	mA
WCDMA B8 HSDPA @ 22.47 dBm	454	mA
WCDMA B8 HSUPA @ 21.17 dBm	497	mA
LTE Data Transfer		
LTE-FDD B1 @ 23.08 dBm	607	mA
LTE-FDD B3 @ 23.69 dBm	636	mA
LTE-FDD B5 @ 23.70 dBm	568	mA
LTE-FDD B7 @ 23.98 dBm	813	mA
LTE-FDD B8 @ 23.16 dBm	591	mA
LTE-FDD B20 @ 23.18 dBm	592	mA
LTE-FDD B28 @ 23.21 dBm	559	mA
LTE-TDD B38 @ 23.13 dBm	230	mA

Conditions	Typ	Unit
LTE-TDD B40 @ 22.72 dBm	233	mA
LTE-TDD B41 @ 23.29 dBm	242	mA
GSM Voice call		
EGSM900 PCL = 5 @ 32.34 dBm	206	mA
EGSM900 PCL = 12 @ 19.11 dBm	76	mA
EGSM900 PCL = 19 @ 6.05 dBm	48	mA
DCS1800 PCL = 0 @ 29.50 dBm	136	mA
DCS1800 PCL = 7 @ 16.07 dBm	61	mA
DCS1800 PCL = 15 @ -1.14 dBm	48	mA
WCDMA Voice call		
WCDMA B1 @ 22.29 dBm	543	mA
WCDMA B5 @ 22.26 dBm	496	mA
WCDMA B8 @ 22.25 dBm	533	mA

The following table show the power consumption of the Pro 4G Module Global variant (SKU: TPX00200).

Conditions	Typ	Unit
Sleep Mode		
AT+CFUN=0 (USB Disconnected)	2.1	mA
EGSM900 @ DRX = 2 (USB Disconnected)	4.2	mA
EGSM900 @ DRX = 5 (USB Disconnected)	3.6	mA
EGSM900 @ DRX = 5 (USB Suspend)	3.9	mA
EGSM900 @ DRX = 9 (USB Disconnected)	3.4	mA
DCS1800 @ DRX = 2 (USB Disconnected)	3.6	mA
DCS1800 @ DRX = 5 (USB Disconnected)	3.0	mA
DCS1800 @ DRX = 5 (USB Suspend)	3.2	mA
DCS1800 @ DRX = 9 (USB Disconnected)	2.8	mA
WCDMA @ PF = 64 (USB Suspend)	3.9	mA
WCDMA @ PF = 128 (USB Disconnected)	3.2	mA
WCDMA @ PF = 256 (USB Disconnected)	2.9	mA
WCDMA @ PF = 512 (USB Disconnected)	2.7	mA
LTE-FDD @ PF = 32 (USB Disconnected)	5.4	mA
LTE-FDD @ PF = 64 (USB Disconnected)	3.9	mA
LTE-FDD @ PF = 64 (USB Suspend)	4.1	mA
LTE-FDD @ PF = 128 (USB Disconnected)	3.2	mA
LTE-FDD @ PF = 256 (USB Disconnected)	2.8	mA
LTE-TDD @ PF = 32 (USB Disconnected)	5.4	mA
LTE-TDD @ PF = 64 (USB Disconnected)	3.8	mA
LTE-TDD @ PF = 64 (USB Suspend)	4.1	mA
LTE-TDD @ PF = 128 (USB Disconnected)	3.2	mA
LTE-TDD @ PF = 256 (USB Disconnected)	2.8	mA
GPRS Data Transfer (GNSS OFF)		
GSM850 1UL/4DL @ 32.1 dBm	376.8	mA
GSM850 2UL/3DL @ 30.0 dBm	547	mA

Conditions	Typ	Unit
GSM850 3UL/2DL @ 28.9 dBm	701	mA
GSM850 4UL/1DL @ 27.6 dBm	794	mA
EGSM900 1UL/4DL @ 32.2 dBm	344.4	mA
EGSM900 2UL/3DL @ 31.2 dBm	560.4	mA
EGSM900 3UL/2DL @ 29.2 dBm	649.4	mA
EGSM900 4UL/1DL @ 27.9 dBm	741.2	mA
DCS1800 1UL/4DL @ 29.2 dBm	205.2	mA
DCS1800 2UL/3DL @ 28.5 dBm	333.7	mA
DCS1800 3UL/2DL @ 26.5 dBm	400.2	mA
DCS1800 4UL/1DL @ 25.7 dBm	480	mA
PCS1900 1UL/4DL @ 29.2 dBm	227.7	mA
PCS1900 2UL/3DL @ 28.1 dBm	363.8	mA
PCS1900 3UL/2DL @ 26.3 dBm	440	mA
PCS1900 4UL/1DL @ 24.9 dBm	507.2	mA
EDGE Data Transfer (GNSS OFF)		
GSM850 1UL/4DL @ 26.3 dBm	212	mA
GSM850 2UL/3DL @ 25.1 dBm	337	mA
GSM850 3UL/2DL @ 23.3 dBm	415	mA
GSM850 4UL/1DL @ 22.2 dBm	487	mA
EGSM900 1UL/4DL @ 26.6 dBm	195	mA
EGSM900 2UL/3DL @ 25.3 dBm	312	mA
EGSM900 3UL/2DL @ 23.7 dBm	392.7	mA
EGSM900 4UL/1DL @ 22.5 dBm	463.5	mA
DCS1800 1UL/4DL @ 25.5 dBm	156.8	mA
DCS1800 2UL/3DL @ 25.0 dBm	260	mA
DCS1800 3UL/2DL @ 23.8 dBm	334	mA
DCS1800 4UL/1DL @ 22.6 dBm	405	mA
PCS1900 1UL/4DL @ 25.4 dBm	169	mA
PCS1900 2UL/3DL @ 24.6 dBm	272	mA
PCS1900 3UL/2DL @ 23.3 dBm	350	mA
PCS1900 4UL/1DL @ 22.0 dBm	418	mA
WCDMA Data Transfer (GNSS OFF)		
WCDMA B1 HSDPA @ 22.5 dBm	735.9	mA
WCDMA B2 HSDPA @ 22.6 dBm	740.6	mA
WCDMA B4 HSDPA @ 22.6 dBm	776.8	mA
WCDMA B5 HSDPA @ 22.3 dBm	670.8	mA
WCDMA B6 HSDPA @ 22.4 dBm	675.3	mA
WCDMA B8 HSDPA @ 22.5 dBm	748.3	mA
WCDMA B19 HSDPA @ 22.4 dBm	676.8	mA
WCDMA B1 HSUPA @ 22.3 dBm	730.8	mA
WCDMA B2 HSUPA @ 22.3 dBm	730.5	mA
WCDMA B4 HSUPA @ 22.0 dBm	742.6	mA
WCDMA B5 HSUPA @ 22.3 dBm	713.9	mA

Conditions	Typ	Unit
WCDMA B6 HSUPA @ 22.4 dBm	717.9	mA
WCDMA B8 HSUPA @ 22.0 dBm	712	mA
WCDMA B19 HSUPA @ 22.3 dBm	710.9	mA
LTE Data Transfer (GNSS OFF)		
LTE-FDD B1 @ 22.8 dBm	966.8	mA
LTE-FDD B2 @ 22.7 dBm	1021.8	mA
LTE-FDD B3 @ 23.0 dBm	1017.7	mA
LTE-FDD B4 @ 23.4 dBm	1052.3	mA
LTE-FDD B5 @ 23.5 dBm	886.3	mA
LTE-FDD B7 @ 23.6 dBm	1114	mA
LTE-FDD B8 @ 23.6 dBm	988.7	mA
LTE-FDD B12 @ 23.1 dBm	811.4	mA
LTE-FDD B13 @ 23.7 dBm	910.7	mA
LTE-FDD B18 @ 23.5 dBm	1038.5	mA
LTE-FDD B19 @ 23.5 dBm	938.8	mA
LTE-FDD B20 @ 23.3 dBm	1014	mA
LTE-FDD B25 @ 22.7 dBm	1001.3	mA
LTE-FDD B26 @ 23.4 dBm	999.4	mA
LTE-FDD B28 @ 23.6 dBm	1004.7	mA
LTE-TDD B38 @ 23.3 dBm	573.8	mA
LTE-TDD B39 @ 23.2 dBm	482.8	mA
LTE-TDD B40 @ 22.7 dBm	508.2	mA
LTE-TDD B41 @ 23.3 dBm	561.9	mA
GSM Voice Call		
GSM850 PCL = 5 @ 31.8 dBm	375.6	mA
EGSM900 PCL = 5 @ 32.2 dBm	366	mA
DCS1800 PCL = 0 @ 29.2 dBm	221	mA
PCS1900 PCL = 0 @ 29.0 dBm	236.6	mA
WCDMA Voice Call		
WCDMA B1 @ 23.0 dBm	780.3	mA
WCDMA B2 @ 23.1 dBm	796.3	mA
WCDMA B4 @ 23.2 dBm	846.2	mA
WCDMA B5 @ 23.2 dBm	731	mA
WCDMA B6 @ 23.2 dBm	739.4	mA
WCDMA B8 @ 23.1 dBm	822.6	mA
WCDMA B19 @ 23.0 dBm	720.9	mA

The following table show the current consumption of the onboard GNSS of the Pro 4G Module EMEA variant (SKU: TPX00201) GNSS.

Description	Conditions	Typ	Unit
Searching (AT+CFUN=0)			
Cold start	@ Passive antenna	67	mA
Lost state	@ Passive antenna	66	mA
Tracking (AT+CFUN=0)	Instrument environment	46	mA

4.5 Antenna Connection

The Arduino Pro 4G Module, both variants, is mounted with three antenna connectors for external antenna connection: a main antenna connector, an Rx-diversity antenna connector, and a GNSS antenna connector (present only in the Global variant of the module). And Rx-diversity function is enabled by default. The impedance of the antenna connectors is 50 Ω .

4.5.1 Operating Frequency

The following table shows the operating frequencies of the Pro 4G Module.

3GPP Band	Transmit	Receive	Unit
GSM850	824-849	869-894	MHz
EGSM900	880-915	925-960	MHz
DCS1800	1710-1785	1805-1880	MHz
PCS1900	1850-1910	1930-1990	MHz
WCDMA B1	1920-1980	2110-2170	MHz
WCDMA B2	1850-1910	1930-1990	MHz
WCDMA B4	1710-1755	2110-2155	MHz
WCDMA B5	824-849	869-894	MHz
WCDMA B6	830-840	875-885	MHz
WCDMA B8	880-915	925-960	MHz
WCDMA B19	830-845	875-890	MHz
LTE-FDD B1	1920-1980	2110-2170	MHz
LTE-FDD B2	1850-1910	1930-1990	MHz
LTE-FDD B3	1710-1785	1805-1880	MHz
LTE-FDD B4	1710-1755	2110-2155	MHz
LTE-FDD B5	824-849	869-894	MHz
LTE-FDD B7	2500-2570	2620-2690	MHz
LTE-FDD B8	880-915	925-960	MHz
LTE-FDD B12	699-716	729-746	MHz
LTE-FDD B13	777-787	746-756	MHz
LTE-FDD B18	815-830	860-875	MHz
LTE-FDD B19	830-845	875-890	MHz
LTE-FDD B20	832-862	791-821	MHz
LTE-FDD B25	1850-1915	1930-1995	MHz
LTE-FDD B26	814-849	859-894	MHz

3GPP Band	Transmit	Receive	Unit
LTE-FDD B28	703–748	758–803	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz
LTE-TDD B39	1880–1920	1880–1920	MHz
LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2496–2690	2496–2690	MHz

4.5.2 Antenna Design Requirements

The following table shows the requirements on main antenna, Rx-diversity antenna and GNSS antenna.

Type	Requirements
GNSS	Frequency range: 1559–1609 MHz
	Polarization: RHCP or linear
	VSWR: < 2 (typ.)
	Passive antenna gain: > 0 dBi
	Active antenna noise figure: <1.5 dB
	Active antenna gain: > 0 dBi
	Active antenna embedded LNA gain: < 17 dB
GSM/UMTS/LTE	VSWR: ≤ 2
	Efficiency: > 30 %
	Max input power: 50 W
	Input impedance: 50 Ω
	Cable insertion loss:
	< 1 dB: LB (<1 GHz)
	< 1.5 dB: MB (1–2.3 GHz)
	< 2 dB: HB (> 2.3 GHz)

5 Module Operation

Both variants of the Arduino Pro 4G Module are designed for use with the Portenta family. To operate, these modules require a compatible carrier and a board from the Portenta family. The specific compatibilities are:

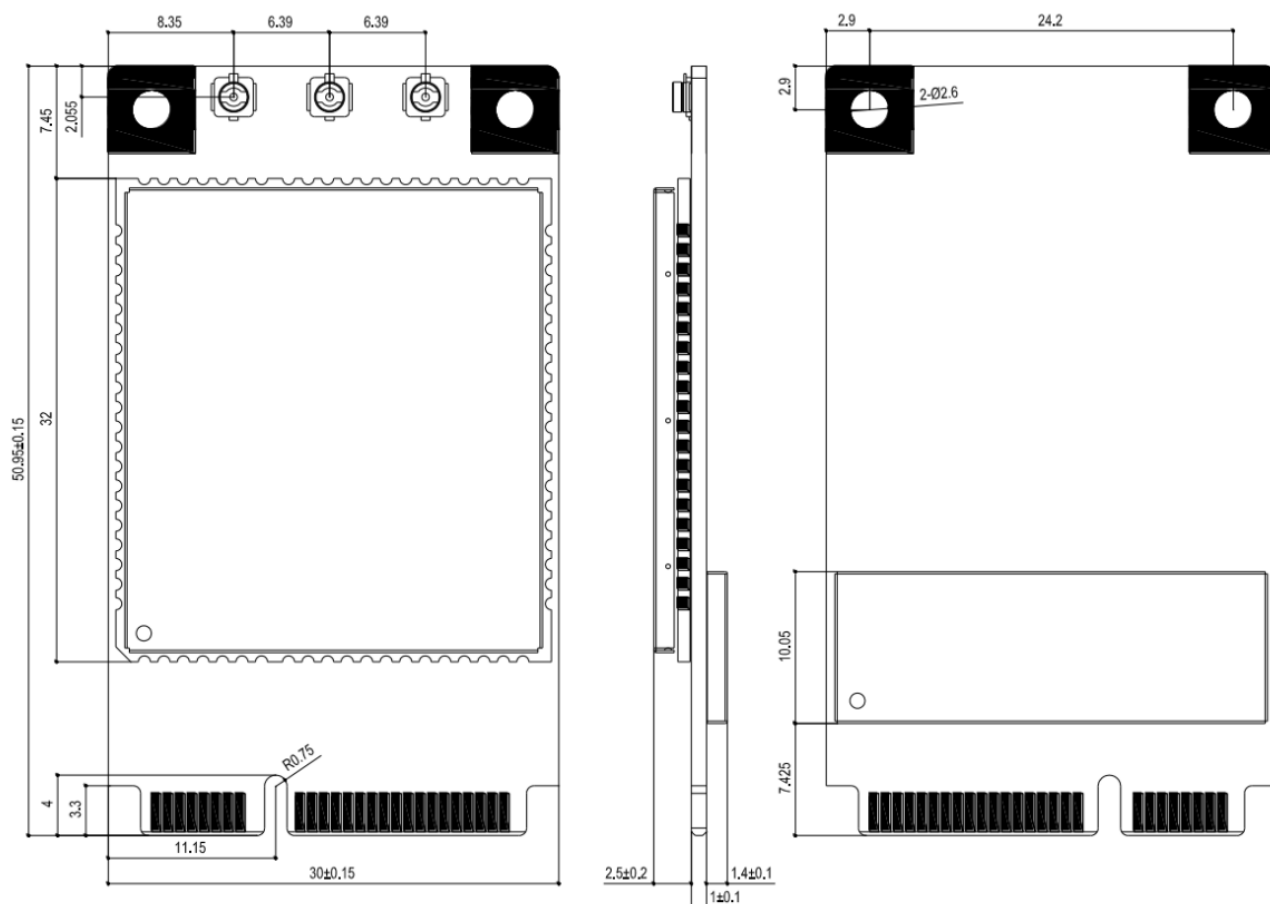
- **Arduino Portenta Mid Carrier:** Compatible with all boards from the Portenta family.
- **Arduino Portenta Max Carrier:** Only compatible with the Portenta X8 board.

The use of the Pro 4G Modules is facilitated through a dedicated Arduino library. For detailed instructions on how to implement and use these modules, refer to the user manual of the Portenta Mid Carrier. This user manual provides all necessary guidelines to ensure proper setup and functionality.

6 Mechanical Information

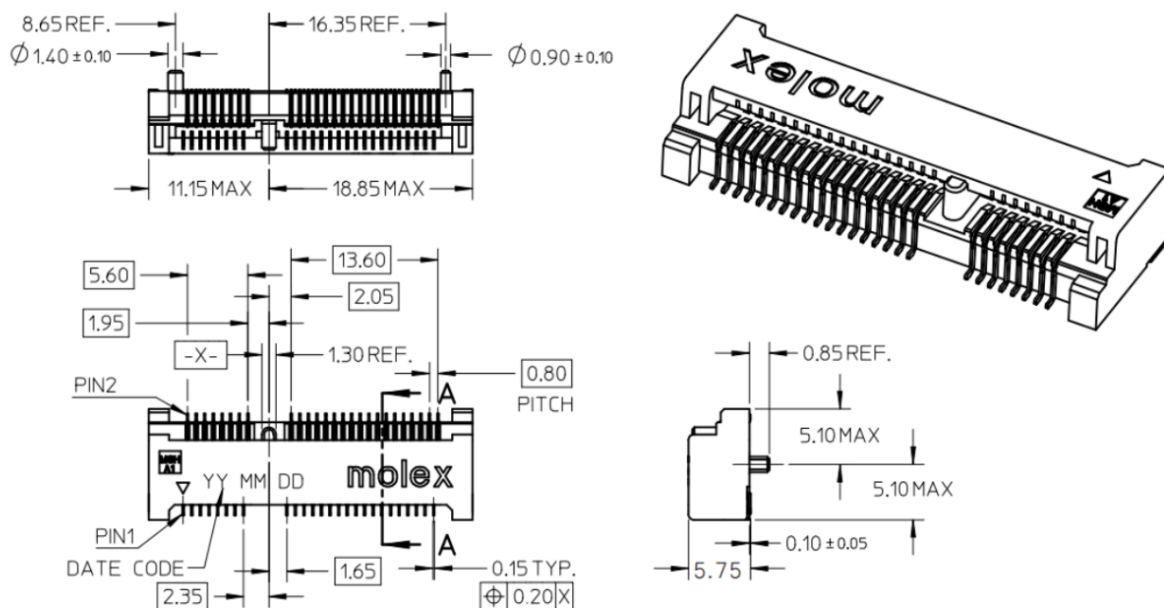
This section mainly describes the mechanical dimensions of the Arduino Pro 4G Module, both variants. All dimensions are measured in millimeters (mm), and the dimensional tolerances are ± 0.15 mm unless otherwise specified.

6.1 Module Dimensions



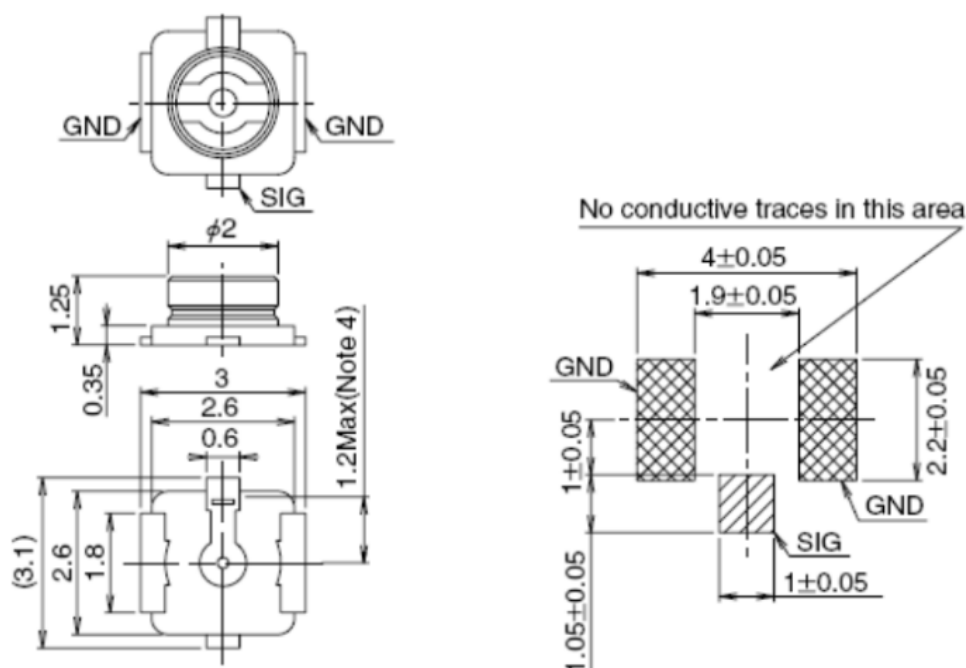
6.2 Standard Dimensions of Mini PCI Express Connector

Both Pro 4G Module variants adopt a standard Mini PCI Express connector which complies with the directives and standards listed in the PCI Express Mini Card Electromechanical Specification Revision 1.2. The following figure takes the Molex 679105700 connector as an example.



6.3 Recommended Mating Plugs for Antenna Connection

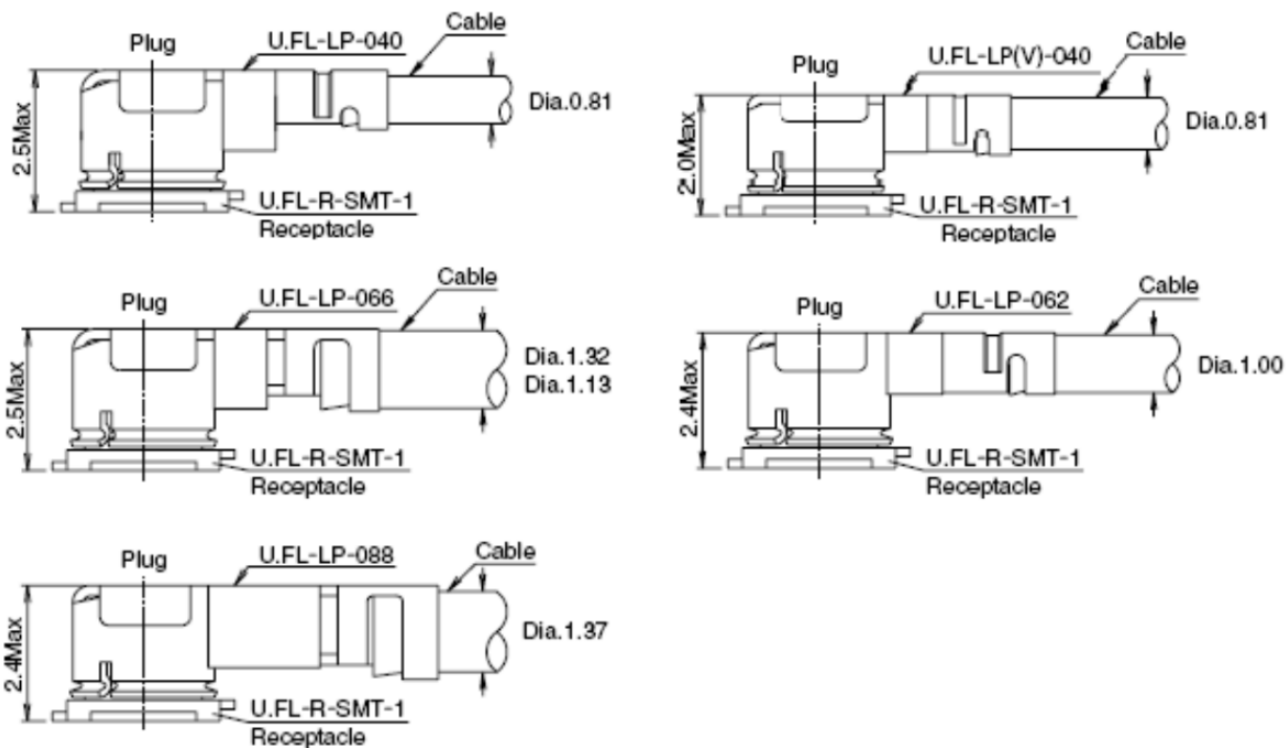
Both Pro 4G Module variants are mounted with RF connectors (receptacles) for convenient antenna connection. The dimensions of the module antenna connectors are shown below.



U.FL-LP mating plugs listed in the following figure can be used to match the receptacles.

Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7
RoHS	YES				

The following figure describes the space factor of mating plugs.



7 Certifications

7.1 Certifications Summary

Certification	EMEA Variant (SKU: TPX00201)	Global variant (SKU: TPX00200)
CE/RED (Europe)	Yes	Yes
UKCA (UK)	Yes	Yes
FCC (USA)	No	Yes
IC (Canada)	No	Yes
RoHS	Yes	Yes
REACH	Yes	Yes

7.2 Declaration of Conformity CE DoC (EU)

We declare under our sole responsibility that the products above are in conformity with the essential requirements of the following EU Directives and therefore qualify for free movement within markets comprising the European Union (EU) and European Economic Area (EEA).

7.3 Declaration of Conformity to EU RoHS & REACH 211 01/19/2021

Arduino boards are in compliance with RoHS 2 Directive 2011/65/EU of the European Parliament and RoHS 3 Directive 2015/863/EU of the Council of 4 June 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Substance	Maximum Limit (ppm)
Lead (Pb)	1000
Cadmium (Cd)	100
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl ethers (PBDE)	1000
Bis(2-Ethylhexyl) phthalate (DEHP)	1000
Benzyl butyl phthalate (BBP)	1000
Dibutyl phthalate (DBP)	1000
Diisobutyl phthalate (DIBP)	1000

Exemptions: No exemptions are claimed.

Arduino Boards are fully compliant with the related requirements of European Union Regulation (EC) 1907 /2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). We declare none of the SVHCs (<https://echa.europa.eu/web/guest/candidate-list-table>), the Candidate List of Substances of Very High Concern for authorization currently released by ECHA, is present in all products (and also package) in quantities totaling in a concentration equal or above 0.1%. To the best of our knowledge, we also declare that our products do not contain any of the substances listed on the "Authorization List" (Annex XIV of the REACH regulations) and Substances of Very High Concern (SVHC) in any significant amounts as specified by the Annex XVII of Candidate list published by ECHA (European Chemical Agency) 1907 /2006/EC.

7.4 Conflict Minerals Declaration

As a global supplier of electronic and electrical components, Arduino is aware of our obligations concerning laws and regulations regarding Conflict Minerals, specifically the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. Arduino does not directly source or process conflict minerals such as Tin, Tantalum, Tungsten, or Gold. Conflict minerals are contained in our products in the form of solder, or as a component in metal alloys. As part of our reasonable due diligence, Arduino has contacted component suppliers within our supply chain to verify their continued compliance with the regulations. Based on the information received thus far we declare that our products contain Conflict Minerals sourced from conflict-free areas.

8 FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC RF Radiation Exposure Statement:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter
2. This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment
3. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Note: 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 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.

English: User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

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

French: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil nedit pas produire de brouillage
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC SAR Warning:

English: This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

French: Lors de l'installation et de l'exploitation de ce dispositif, la distance entre le radiateur et le corps est d'au moins 20 cm.

Important: The operating temperature of the EUT can't exceed 85 °C and shouldn't be lower than -40 °C.

Hereby, Arduino S.r.l. declares that this product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU. This product is allowed to be used in all EU member states.

9 Company Information

Company name	Arduino S.r.l.
Company address	Via Andrea Appiani, 25 - 20900 Monza (Italy)

10 Reference Documentation

Ref	Link
Arduino IDE (Desktop)	https://www.arduino.cc/en/Main/Software
Arduino IDE (Cloud)	https://create.arduino.cc/editor
Arduino Cloud - Getting started	https://docs.arduino.cc/arduino-cloud/getting-started/iot-cloud-getting-started
Project Hub	https://create.arduino.cc/projecthub?by=part&part_id=11332&sort=trending
Library Reference	https://www.arduino.cc/reference/en/
Online Store	https://store.arduino.cc/

11 Document Revision History

Date	Revision	Changes
09/04/2024	1	First release

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