

TUGE LTE CAT 4 Mini PCIe module TM22 Specification



The TM22 Mini PCIe is an LTE module (data only) that supports the PCI Express Mini Card standard interface. TM22 module supports LTE CAT4 delivering 150Mbps downlink and 50Mbps uplink data rates. It also supports UMTS/HSPA technology, R99 WCDMA with a maximum downlink and uplink rate of 384Kbps, 3GPP R7 CAT14 HSDPA with 21Mbps and 3GPP R7 CAT7 HSUPA with 5.76Mbps.

The TM22 supports Multiple Input Output technology (MIMO), which allows multiple receive antennas to be used at the receiving end, allowing signals to be received through multiple antennas at the receiving end, thus reducing BER and improving communication quality.

The TM22 module supports Cloud-SIM™ technology. TM22 supports the full global 4G bands and intelligently and automatically selects the registered network based on network signal coverage for optimal coverage and performance.

The TM22 module has a rich built-in network protocol, integrates several industry standard interfaces and supports Windows/Linux/Android operating systems, greatly expanding the scope of application of the module in the M2M field, such as remote monitoring devices, automotive devices, wireless POS device, smart meter devices, wire-free switches and other terminals.



Key Benefits

- LTE category 4 module optimized for broadband IoT applications.
 - Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage.
 - Supports full global frequency bands and 200+ operator networks in 140+ countries/regions based on cloud-SIM technology, providing optimal network coverage and performance.
 - Can be designed to facilitate device hardware without inserting a physical physical USIM card .
 - Standard PCI Express® Mini Card form factor (Mini PCIe) ideal for manufacturers to easily integrate wireless connectivity into their devices.
 - MIMO technology meets demands for data rate and link reliability in modem wireless communication systems.
- Rich interface with support for GPS/Beidou, WiFi, USB.

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Specification

Bands

- LTE FDD: B1/B2/B3/B4/B5/B7/B8/B9/B12/B13/B17/B18/B19/B20/B25/B26/B28/B66
- LTE TDD: B34/B38/B39/B40/B41
- WCDMA/HSPA: B1/B2/B4/B5/B8
- GSM/GPRS/EDGE: B2/B3/B5/B8

Peak data rate

- LTE FDD: 150Mbps (DL) / 50Mbps (UL)
- LTE TDD: 130Mbps (DL) / 30Mbps (UL)
- HSDPA: 21Mbps (DL)
- HSUPA: 5.76Mbps (UL)
- WCDMA: 384Kbps (DL) / 384Kbps (UL)
- EDGE: 296Kbps (DL) / 236.8Kbps (UL)
- GPRS: 107Kbps (DL) / 85.6Kbps (UL)

Sensitivity

LTE

- FDD B1: -99.5dBm (10M)
- FDD B2: -99.9dBm (10M)
- FDD B3: -99.8dBm (10M)
- FDD B4: -99.7dBm (10M)
- FDD B5: -99.9dBm (10M)
- FDD B7: -99.1dBm (10M)
- FDD B8: -99.8dBm (10M)
- FDD B9: -99.8dBm (10M)
- FDD B12: -99.8dBm (10M)
- FDD B13: -100.1dBm (10M)
- FDD B17: -100.0dBm (10M)
- FDD B18: -100.0dBm (10M)
- FDD B19: -99.8dBm (10M)
- FDD B20: -99.7dBm (10M)
- FDD B25: -100.2dBm (10M)
- FDD B26: -100.0dBm (10M)
- FDD B28: -99.8dBm (10M)
- FDD B66: -100.0dBm (10M)
- TDD B34: -99.7dBm (10M)
- TDD B38: -99.2dBm (10M)
- TDD B39: -99.8dBm (10M)
- TDD B40: -99.7dBm (10M)
- TDD B41: -99.3dBm (10M)

WCDMA

- B1: -109.2dBm
- B2: -110dBm
- B4: -109.5dBm
- B5: -110dBm
- B8: -109.2dBm

GSM/GPRS/EDGE

- B2: -107.5dBm
- B3: -107.5dBm
- B5: -108dBm
- B8: -108dBm

Output power

- Class 3 (23dBm±2dB) for LTE FDD
- Class 3 (23dBm±2dB) for LTE TDD
- Class 3 (23dBm±2dB) for WCDMA
- Class 4 (33dBm±2dB) for EGSM 900M
- Class 1 (30dBm±2dB) for DCS 1800M

Consumption

- 4.0mA@LTE sleep (PF=128)
- 3.7mA@LTE sleep (PF=256)
- 30mA@idle

Interface

- USB x 1: USB 2.0 with High Speed up to 480Mbps
- UART x 1: Main
- Solder pads for Main Antenna, Rx-diversity and GNSS Antennas

Enhanced Features

- Supports full global frequency bands and 200+ operator networks in 140+ countries /regions based on cloud-SIM technology, providing optimal network coverage and performance
- Delta Firmware Upgrade Over-The-Air
- Downlink MIMO (Supports Rx-diversity Antenna)
- GNSS: GPS/BeiDou

General Features

- 3GPP E-UTRA Release 11
- Bandwidth: 1.4/3/5/10/15/20MHz
- Operating Temperature Range: -20to +60 °C
- Extended Temperature Range: -30 to +70 °C
- Dimension: 51.0mm*30.0mm*5.1mm
- Adopting standard PCI Express® Mini Card form factor (Mini PCIe)
- Supply Voltage: 3.0V~3.6V, 3.3V Typ.
- About 12g
- 3GPP TS27.007 and Enhanced AT Commands

Software Features

- USB Serial Driver: : Windos 7/8/8.1/10
Linux 2.6/3.x/4.1~4.15 Android 4.x/5.x/6.x /7.x/9.x
- NDIS Driver: Linux 2.6/3.x/4.1~4.15
- ECM Driver: Linux 2.6/3.x/4.1~4.15
- Protocols: TCP/UDP/HTTP/NTP/PING



FCC Warning Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. 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.

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.

RF Exposure Statement

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance of 20cm the radiator your body. This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies.

DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of Title 47 (Part 2, Part 22, Part 24, Part 27, Part 90)

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT uses FPC Antenna, antenna gain: 1dBi. There is no restriction on the installation method.

2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a limited module. The host should use FPC antenna to the module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.⁴

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: No. The module without trace antenna designs

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons. FCC ID is: 2AU4T-TM22-LCC

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT uses FPC Antenna, antenna gain: 1dBi.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AU4T-TM22-LCC

2.9 Information on test modes and additional testing requirements

5 Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a standalone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: Data transfer module demo board can control the EUT work in RF test mode at specified test channel

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B