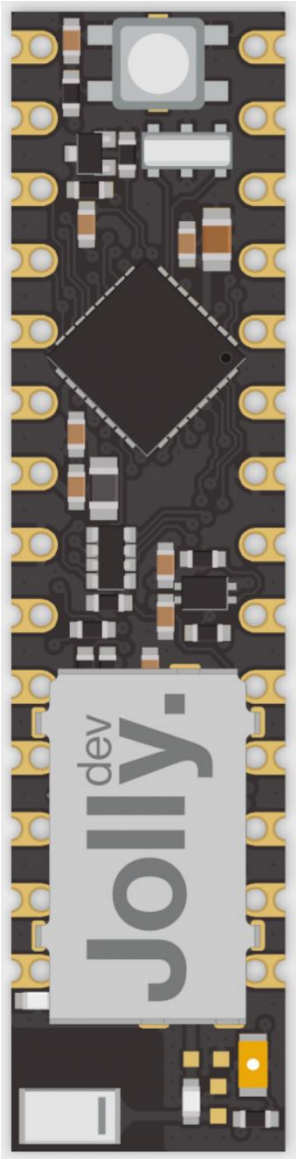
Jolly

Wi-Fi module
User Manual



Jolly dev

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1. Revision History

Revision number	Revision date	Summary of changes	Authors
1.0	12/12/2022	Initial version	D. Trimarchi

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.

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3. Introduction

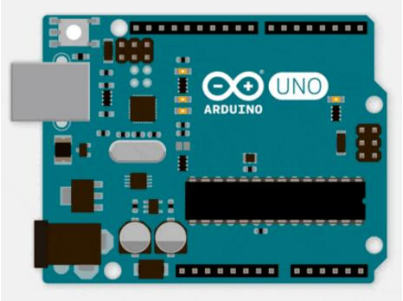
Jolly is a new electronic module for makers and Arduino UNO lovers. This Arduino Uno-compatible module has integrated Wi-Fi and has been designed to be the replacement of the Arduino UNO's ATmega328P.

It can be used as a replacement of the ATmega328P (as shown in the pictures below) or as a stand-alone module, placed on a breadboard or soldered in a new board.

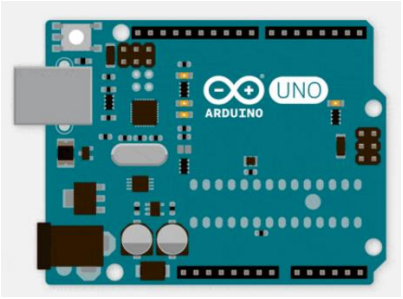
The reference markets/application areas are: prototyping, makers, IoT

Example of how to use Jolly Module with ad Arduino UNO.

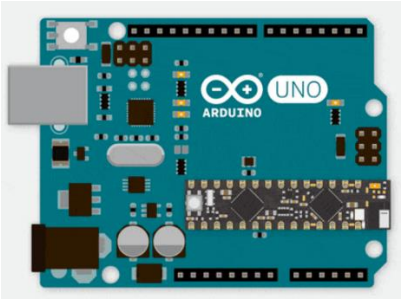
1) Take an Arduino UNO



2) Remove the ATmega328P



3) Replace it with the Jolly module



For more info, please visit: [Jolly DEV (jolly-dev.com)]

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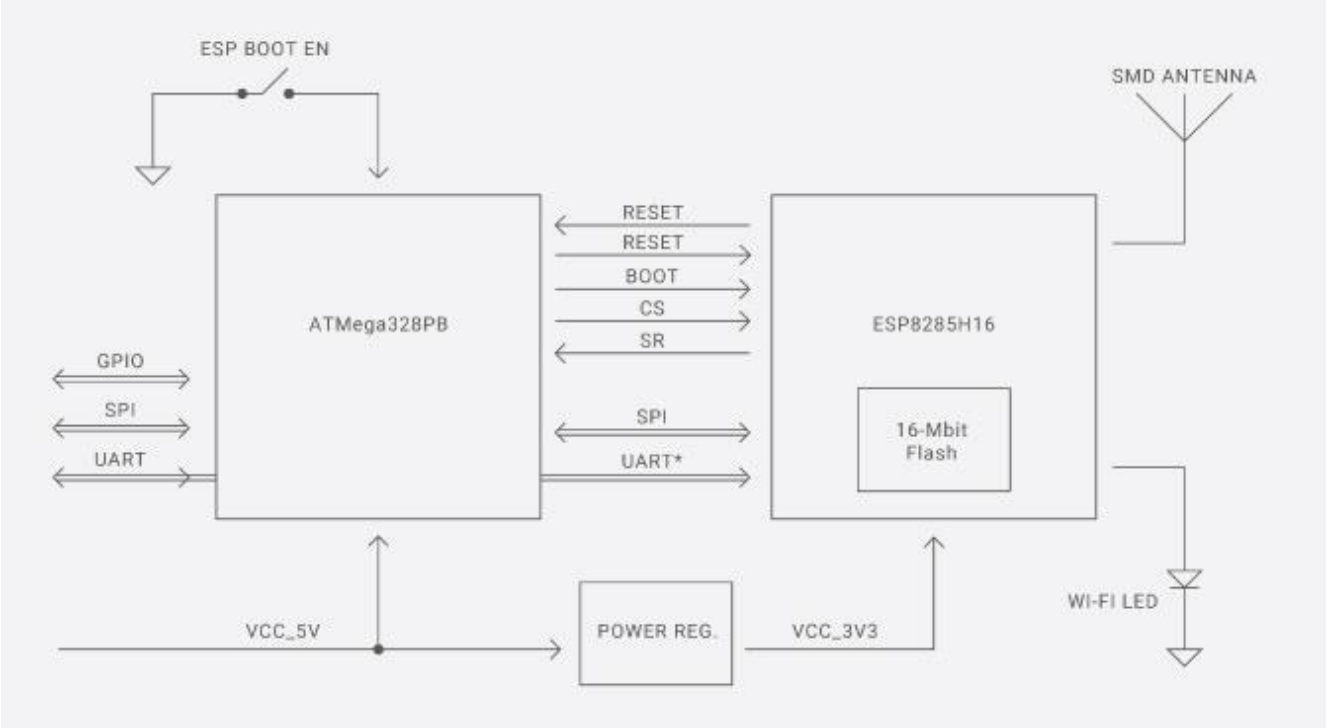
4. Block Diagram



The picture above shows the functional block diagram of the Jolly module.

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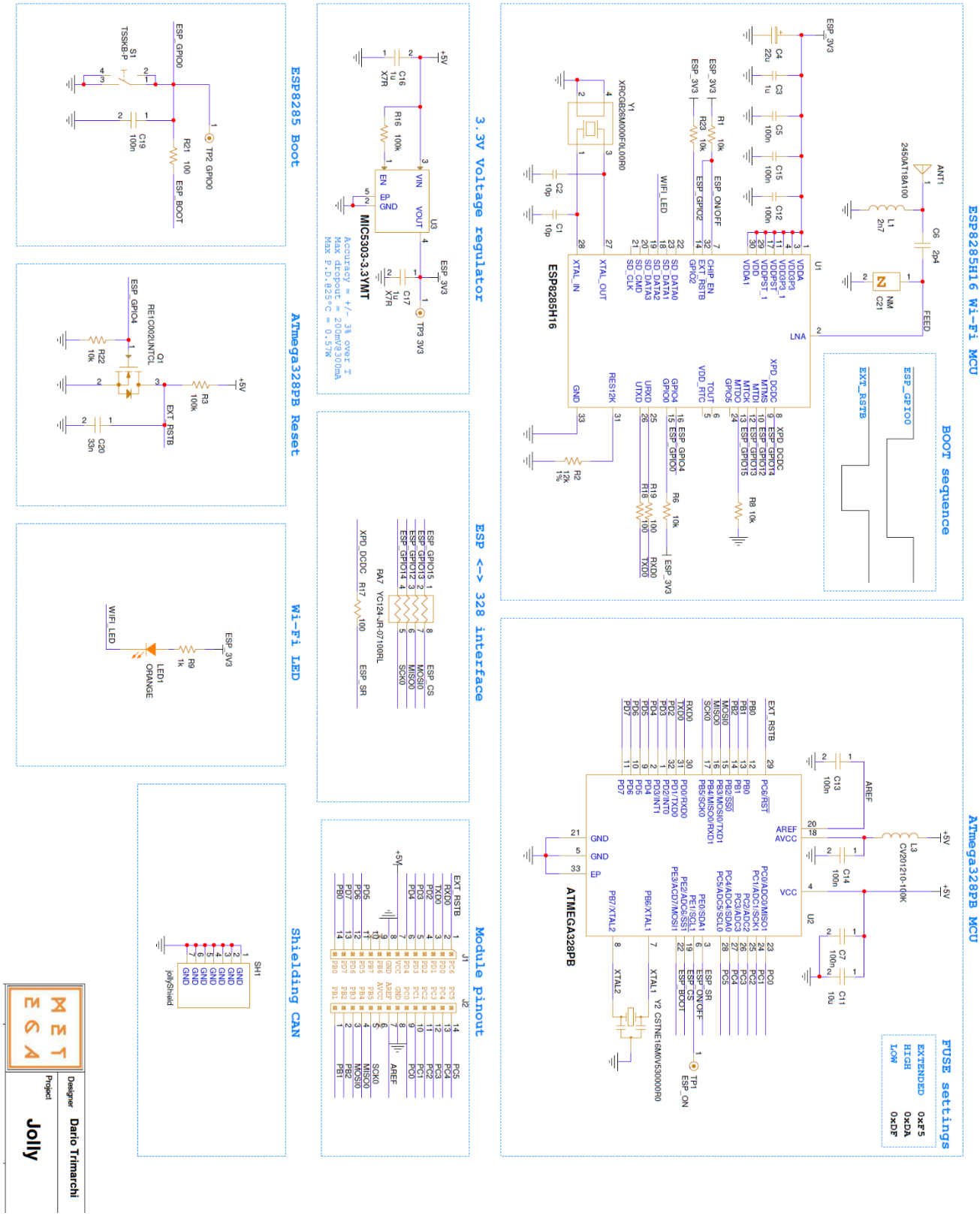
5. Schematic



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6. Software

Since the Jolly module has been designed to replace the ATMega328P of the Arduino UNO, it allows us to preserve the full compatibility of the pinout, firmware, and hardware architecture of its predecessor. Therefore, a secondary microcontroller was inserted to allow the addition of Wi-Fi functionality, the ESP8285.

The two microcontrollers are connected to each other through two digital interfaces – as can be seen from the schematic in the previous section: one SPI and one UART. In particular, the SPI interface – which is the same exposed on the pinout of the module – is used for data exchange, while the UART, is mainly used for programming the ESP8285 and for communication/programming of the ATMega328PB. The ESP8285 serial interface is active only during the programming phase so as not to interfere with the normal operation of the serial on ATMega328PB. The programming of the Wi-Fi chip is possible thanks to the presence of a boot key and a special firmware in the ATMega328PB.

To have the whole module working properly, a custom Arduino Core has been designed for both the MCUs:

- The Jolly AVR platform (tech-jollydev/jolly-arduino-platform (github.com))
- The Jolly ESP platform (tech-jollydev/jolly-arduino-esp8285-platform (github.com))

NOTE: *to ensure a proper working of both the platforms, the Arduino IDE version 1.8.13 or higher is strongly recommended.*

Platforms Installation

To install the Jolly AVR platform in the Arduino IDE it is necessary to follow the following steps:

- select the Preferences tab in the file menu
- add the following links to the Additional Boards Manager URLs:
  https://tech-jollydev.github.io/package_jolly_index.json
  https://espressif.github.io/arduino-esp32/package_esp32_index.json
  https://arduino.esp8266.com/stable/package_esp8266com_index.json
- select the board menu in the tools menu and finally select the boards manager option
- by typing “jolly” in the search bar, the *Jolly AVR Boards* platform and the *Jolly advanced* platform should appear
- now the platforms can be installed

Update the ESP8285 firmware

A pre-compiled version of the default ESP8285 firmware is available under the path */firmwares/jolly_esp/* .

The firmware is composed by two files: WiFiManager.bin and WiFiManager_spiff.bin. In case the firmware needs to be updated for any reason, there is a specific semi-automatic procedure to follow:

- in Arduino IDE select the tools menu
- choose ESP8285 for the bootloader option as shown in the picture below

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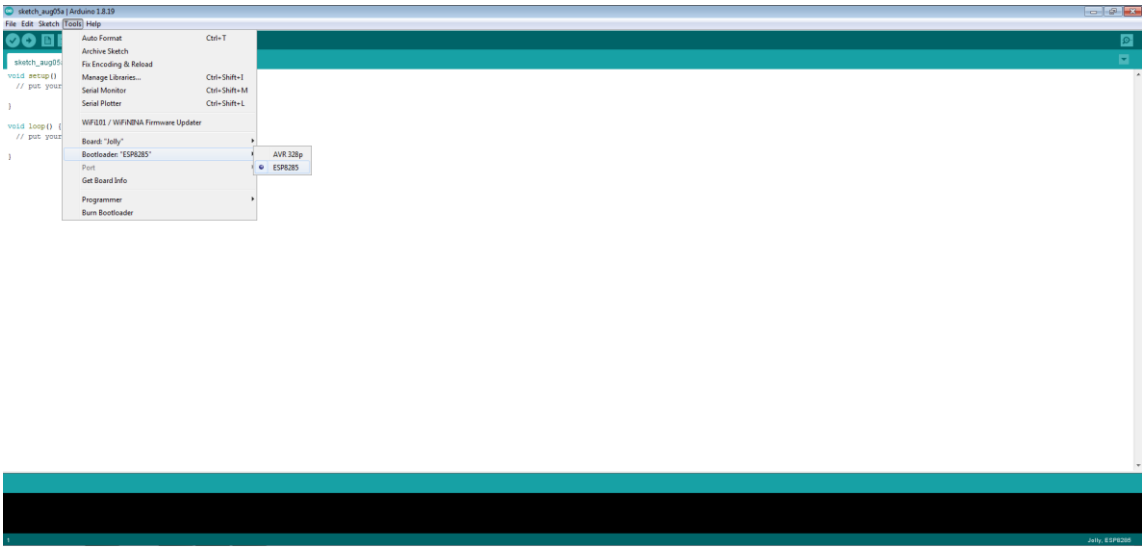
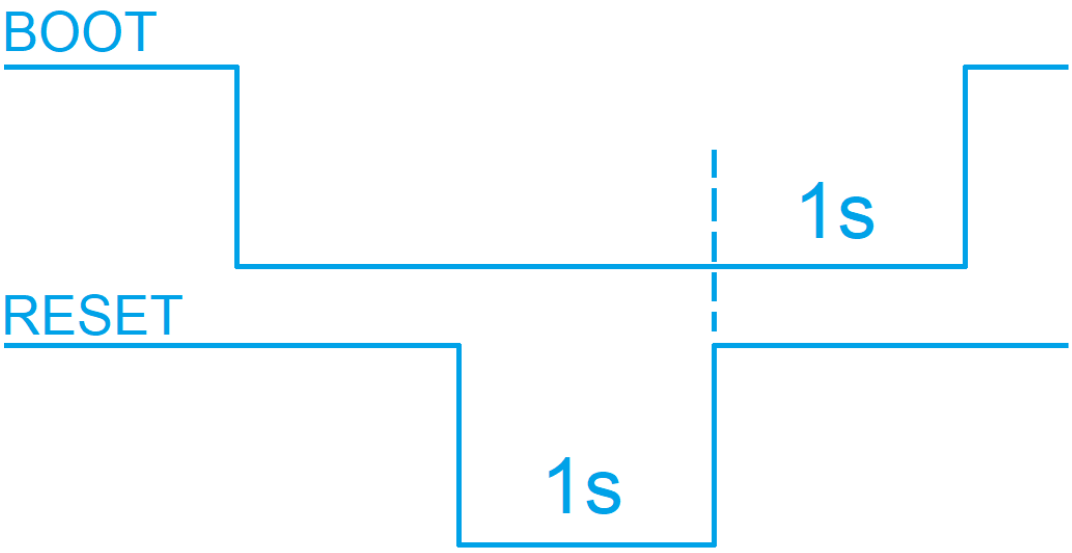


- press the boot button located on the Jolly module. While holding it pressed, press the reset button on the Arduino UNO for 1 second, then release it. Keep holding the boot button for 1 second longer, then release it



Now the Jolly is entered in the boot mode for the ESP8285

- finally click on burn bootloader option and the procedure will start automatically

HINT: *to keep track of the update process, enable both the compilation and upload radio button in the show verbose output during: option located in the file menu Preferences tab of the Arduino IDE*

To fully customize the code running on ESP8285 the dedicated platform must be used.

To trigger the firmware update, the process is the same as depicted before: press the boot button located on the Jolly module; while holding it pressed, press the reset button on the Arduino UNO for 1 second, then release it. Keep holding the boot button for 1 second longer, then release it. Now Jolly module is in boot mode and a new firmware can be uploaded.

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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 Part 15 Subpart C Section 15.247

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 Ceramic Antenna, antenna gain: 0.5dBi. 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.

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:

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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 with 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 device is mobile, portable, and the use distance is 20 cm. This module is designed to comply with the FCC statement, FCC ID is: 2ATX7-JOLLYMODULE.

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 Ceramic Antenna, antenna gain: 0.5dBi.

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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 he following texts: "Contains FCC ID: 2ATX7-JOLLYMODULE

2.9 Information on test modes and additional testing requirements5

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 circuity), 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 circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

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