

# Manual

## TX-M2430

2.4GHz RF + BLE4.2 Dual Mode Module

# Notice

Techxen continually work to improve the performance and quality of products. The information in this document has been carefully checked and is believed to be entirely accurate at the release time. Please, ensure that Techxen's product must be working within this specification. But, Techxen assumes no responsibility, however, for possible errors or missing, or for any result from the use of the information contained documents. Techxen can change the specification at any time without notice and is not required to update this documentation to reflect such changes.

## Revision History

| Revision | Data       | Description  |
|----------|------------|--|
| 0.1      | 2017.03.28 | Initial release<br>2.4GHz RF + BLE4.2 Dual Mode Module   |
| 0.2      | 2017-06-22 | 7. RF Specification update<br>10. Reference Peripheral Circuit Update<br>11. Antenna Design Guide Update<br>12. SMT Temperature Sequence (Pb-free) Update<br>13. Packing Information |
|          |            |  |
|          |            |  |

## Version Information

- Software Version : V 1.0
- Hardware Version : V 1.0

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## 1. Scope

It's compatible with Bluetooth standard supporting BLE specification up to version 4.2. It allows easy connectivity with Bluetooth Smart Ready mobile phones, tablets, and laptops, which support BLE slave and master mode operation, including broadcast, encryption, connection updates, and channel map updates.

### Application :

- **Smartphone and tablet accessories**
- **Remote control and 3D glasses**
- **Sports and fitness tracking**
- **Wearable devices**

## 2. Features

- Embedded 32-bit high performance MCU with clock up to 48MHz.
- Program memory: internal 512KB Flash
- Data memory: 16KB on-chip SRAM.
- 12MHz/16MHz & 32.768KHz Crystal and 32KHz/32MHz embedded RC oscillator.
- Up to 21 GPIOs depending on package option;
- DMIC(Digital Mic)
- AMIC (Analog Mic);
- Mono-channel Audio output;
- UART with hardware flow control;
- SPI/ I2C/ USB/ Debug Interface
- Up to 6 channels of PWM, 2-channel IR.
- Sensor: 14bit ADC with PGA / Temperature sensor.
- One quadrature decoder.
- Embedded hardware AES.
- Supports Apple Home Kit without external DSP.

### 3. Block Diagram

Confidential

## 4. Product Information

### 4.1 Mechanical Information

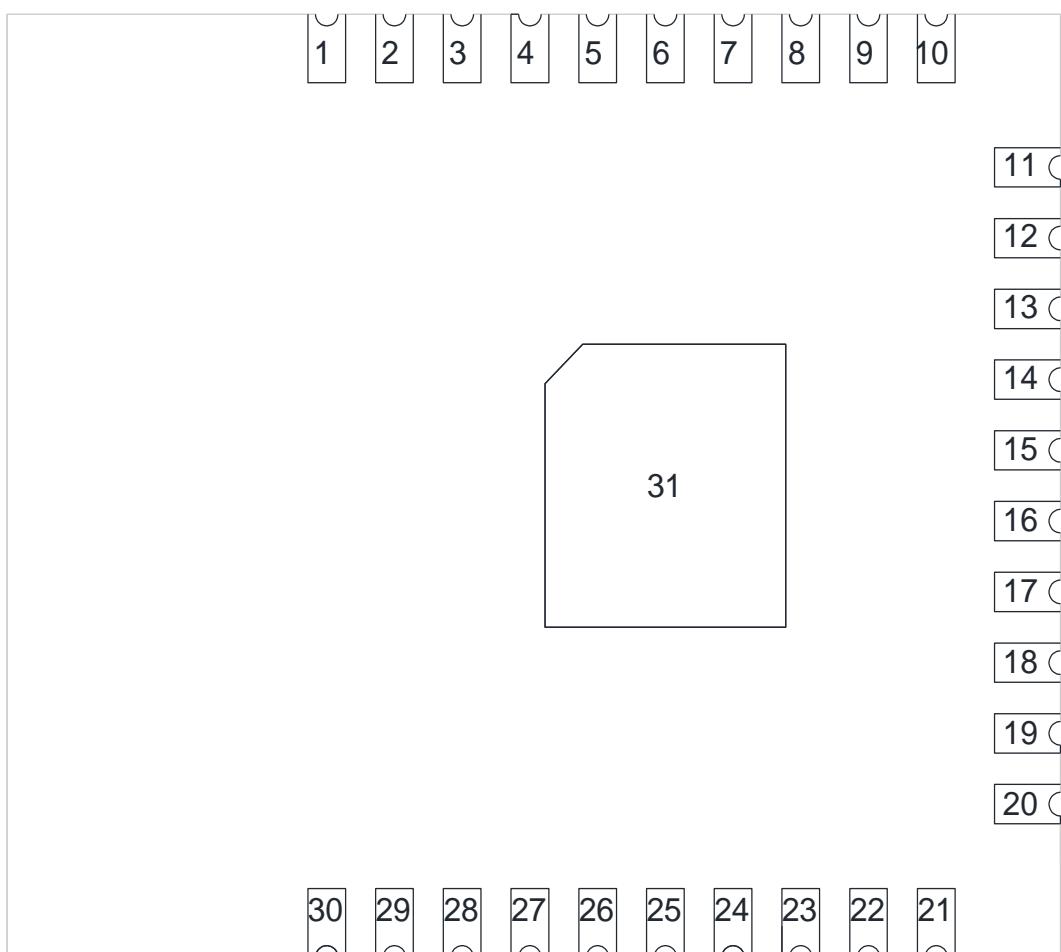
|          |      |    |
|----------|------|----|
| - Length | 14   | mm |
| - Width  | 12   | mm |
| - Height | 1.9  | mm |
| - Weight | 0.47 | g  |

### 4.2 Temperature Information

|                         |                |
|-------------------------|----------------|
| - Operating temperature | -30°C ~ +85°C  |
| - Storage temperature   | -40°C ~ +125°C |

## 5. Pin Description

[Top View]



| Pin | Name                 | Type | Description   |
|-----|----------------------|------|---|
| 1   | GND                  | -    | Ground  |
| 2   | PWM1/SDM_N/ANA_E1    | I/O  | PWM1 output/GPIO /SDM Negative output /ANA_E<1>                                   |
| 3   | PWM0/SDM_P/ANA_E0    | I/O  | PWM0 output/GPIO /SDM Positive output/ANA_E<0>                                    |
| 4   | RESETB               | I    | Power on reset, active low  |
| 5   | GP5/ANA_D3           | I/O  | GPIO5/ANA_D<3>  |
| 6   | GP4/ANA_D2           | I/O  | GPIO4/ANA_D<2>  |
| 7   | UART_CTS/PWM5/ANA_C5 | I/O  | UART_CTS/PWM5 output/ GPIO /ANA_C<5>  |
| 8   | UART_RTS/PWM4/ANA_C4 | I/O  | UART_RTS/PWM4 output/GPIO /ANA_C<4>   |
| 9   | UART_RX/PWM3/ANA_C3  | I/O  | UART_RX/PWM3 output/ GPIO /ANA_C<3>/(optional) 32KHz crystal input                |
| 10  | UART_TX/PWM2/ANA_C2  | I/O  | UART_TX/PWM2 output/ GPIO/GPIO/GPIO/GPIO/ANA_C<2>/(optional) 32KHz crystal output |
| 11  | CK/PWM5_N/ANA_B7     | I/O  | SPI clock/PWM5 inverting output/GPIO/ANA_B<7>/I2C_SCK(I2C serial clock)           |
| 12  | DI/PWM5/ANA_B6       | I/O  | SPI data input/PWM5 output/GPIO/ANA_B<6>/I2C_SDA(I2C serial data)                 |
| 13  | DO/PWM4_N/ANA_B5     | I/O  | SPI data output/PWM4 inverting/Output/GPIO/ANA_B<5>                               |
| 14  | CN/PWM4/ANA_B4       | I/O  | SPI chip select(Active low)/PWM4 Output/GPIO/ANA_B<4>                             |
| 15  | PWM2_N/ANA_B1        | I/O  | PWM2 inverting output /GPIO/ANA_B<1>  |
| 16  | PWM2/SWS/ANA_B0      | I/O  | PWM2 output/Single wire slave/GPIO/ANA_B<0>                                       |
| 17  | UART_RX/SWM/ANA_A7   | I/O  | UART_RX/Single Wire Master/GPIO/ANA_A<7>  |
| 18  | GND                  | -    | Ground  |
| 19  | VDD_3V3              | I    | Power supply voltage : 3.3V   |
| 20  | GND                  | -    | Ground  |
| 21  | CK/PWM1_N/ANA_A4     | I/O  | SPI clock/PWM1 inverting output/GPIO/ANA_A<4>/I2C_SCK (I2C serial clock)          |
| 22  | DI/PWM1/ANA_A3       | I/O  | SPI data input/PWM1 output/GPIO/ANA_A<3>/I2C_SDA (I2C serial data)                |
| 23  | DMIC_CLK/ANA_A1      | I/O  | DMIC clock/GPIO/ANA_A<1>  |
| 24  | DMIC_DI/PWM0/ANA_A0  | I/O  | DMIC data input/PWM0/GPIO/ANA_A<0>  |
| 25  | DP/ANA_E3            | I/O  | USB data positive/GPIO/ANA_E<3>   |
| 26  | DM/ANA_E2            | I/O  | USB data Minus/GPIO/ANA_E<2>  |
| 27  | GND                  | -    | Ground  |
| 28  | RF                   | I/O  | RF In/Out port  |
| 29  | ANT                  | I/O  | Internal Antenna port   |
| 30  | GND                  | -    | Ground  |
| 31  | GND                  | -    | Ground  |

## 6. Electrical Specification

### 6.1 Absolute Maximum Rating

| Symbol                    | Min  | Max     | Unit |
|---------------------------|------|---------|------|
| Supply Voltage            | -0.3 | 3.9     | V    |
| Voltage on input Pin      | -0.3 | VDD+0.3 | V    |
| Output Voltage            | 0    | VDD     | V    |
| Storage temperature Range | -65  | 150     | °C   |

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### 6.2 Recommended Operating condition

|                             | Min | Typ | Max | unit | Condition   |
|-----------------------------|-----|-----|-----|------|-------------|
| Power Supply Voltage        | 1.9 | 3.3 | 3.6 | V    |             |
| Operating Temperature Range | -40 | -   | 85  | °C   | ET Versions |
|                             | -40 | -   | 125 | °C   | AT Versions |

### 6.3 Current Consumption

|                    | Min | Typ | Max | unit | Condition                                     |
|--------------------|-----|-----|-----|------|---|
| Tx                 | -   | 15  | -   | mA   | Continuous Tx transmission,<br>0dBm out power |
| Rx                 | -   | 12  | -   | mA   | Continuous Rx reception                       |
| Suspend Current    | -   | 10  | 50  | uA   | IO wake up                                    |
|                    | -   | 12  | 52  | uA   | Timer wakeup                                  |
| Deep sleep current | -   | 2   | 5   | uA   |   |

### 6.4 AC characteristics

#### 6.4.1 Digital inputs/outputs

| Symbol              | Min     | Typ | Max    | unit | Condition |
|---------------------|---------|-----|--------|------|-----------|
| Input high voltage  | 0.7VDD  | -   | VDD    | V    |           |
| Input low voltage   | VSS     | -   | 0.3VDD | V    |           |
| Output high voltage | VDD-0.3 | -   | VDD    | V    |           |
| Output low voltage  | VSS     | -   | 0.3    | V    |           |

#### 6.4.2 USB Characteristics

| Symbol                               | Min | Typ | Max | unit | Condition |
|--------------------------------------|-----|-----|-----|------|-----------|
| USB Output Signal Cross-over Voltage | 1.3 | -   | 2.0 | V    |           |

## 7. RF Specification

Nomal Condition : 25deg.C, VBAT=3.3V, VDDIO=3.3V

| Bluetooth LE(Low Energy)              | Min | Typ | Max  | Unit |
|---------------------------------------|-----|-----|------|------|
| Output Power                          | -   | 3   | 4    | dBm  |
| Modulation Characteristics            |     |     |      |      |
| Delta f1avg                           | 225 | -   | 275  | KHz  |
| Delta f2max (at 99.9%)                | 99  | -   | -    | %    |
| Delta f2avg / Delta f1avg             | 0.8 | -   | -    | %    |
| Carrier Frequency Offset and Drift    |     |     |      |      |
| Frequency Offset                      | -   | -   | 150  | KHz  |
| Frequency Drift                       | -   | -   | 50   | KHz  |
| Drift Rate                            | -   | -   | 20   | KHz  |
| Receiver Sensitivity(PER<30.8%)       | -70 | -   | -    | dBm  |
| Maximum Input Signal Level(PER<30.8%) | -10 | -   | -    | dBm  |
| PER Report Integrity (-30dBm Input)   | 50  | -   | 65.4 | %    |

| Zigbee  | Min  | Typ | Max  | Unit |
|---|------|-----|------|------|
| Frequency Range   | 2405 |     | 2480 | MHz  |
| Channel Bandwidth   | -    | 5   | -    | MHz  |
| Received RF Bandwidth   | -    | 2   | -    | MHz  |
| Output Power  | -    | 5   | 6    | dBm  |
| EVM ALL   | -    | -   | 35   | %    |
| Phase Error   | -    | 6.5 | -    | Deg  |
| Lo Leakage  | -    | -50 | -    | dB   |
| Frequency Error   | -96  | -   | 96   | KHz  |
| Receiver Sensitivity(PER<1%, Packet length of 22byte)@250kbps | -85  | -   | -    | dBm  |

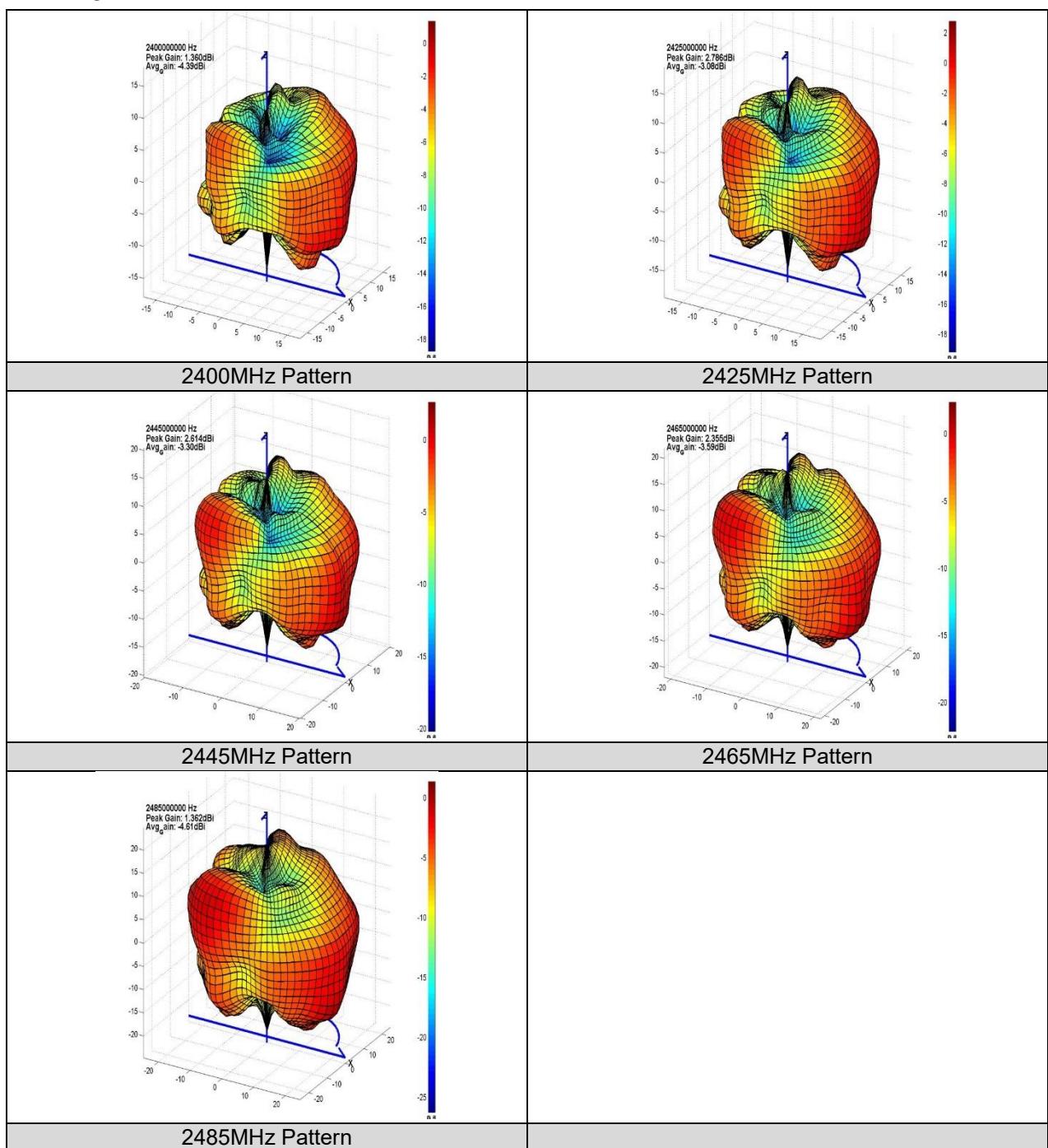
! TX-M2430 module is not capable of transmitting BLE signal and Zigbee signal simultaneously

## 8. Internal Pattern Antenna Specification

### 8.1 Antenna Gain

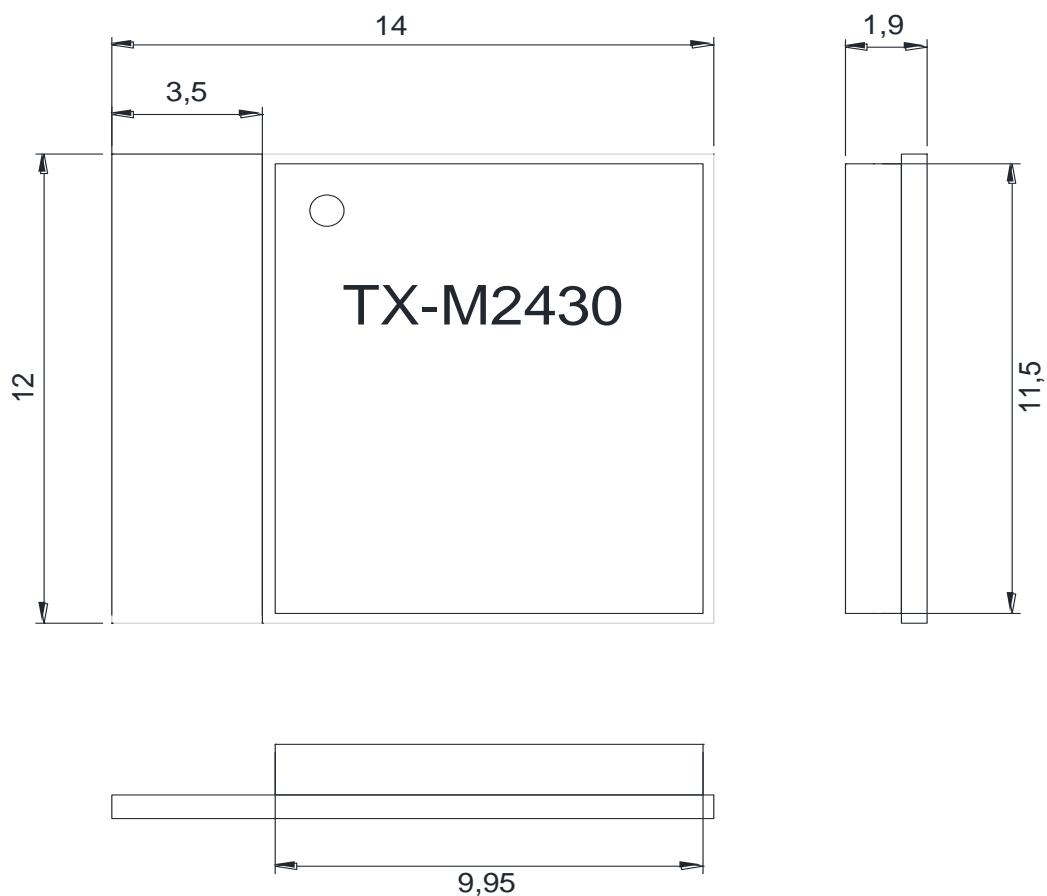
| Frequency | Efficiency | Average Gain | Max Gain | Max Position    |
|-----------|------------|--------------|----------|-----------------|
| 2400MHz   | 36.4 %     | -4.4 dBi     | 1.4 dBi  | Theta105/Pie60  |
| 2425MHz   | 49.1 %     | -3.1 dBi     | 2.8 dBi  | Theta105/Pie60  |
| 2445MHz   | 46.7 %     | -3.3 dBi     | 2.6 dBi  | Theta105/Pie60  |
| 2465MHz   | 43.7 %     | -3.6 dBi     | 2.4 dBi  | Theta105/Pie60  |
| 2485MHz   | 34.5 %     | -4.6 dBi     | 1.4 dBi  | Theta105/Pie240 |

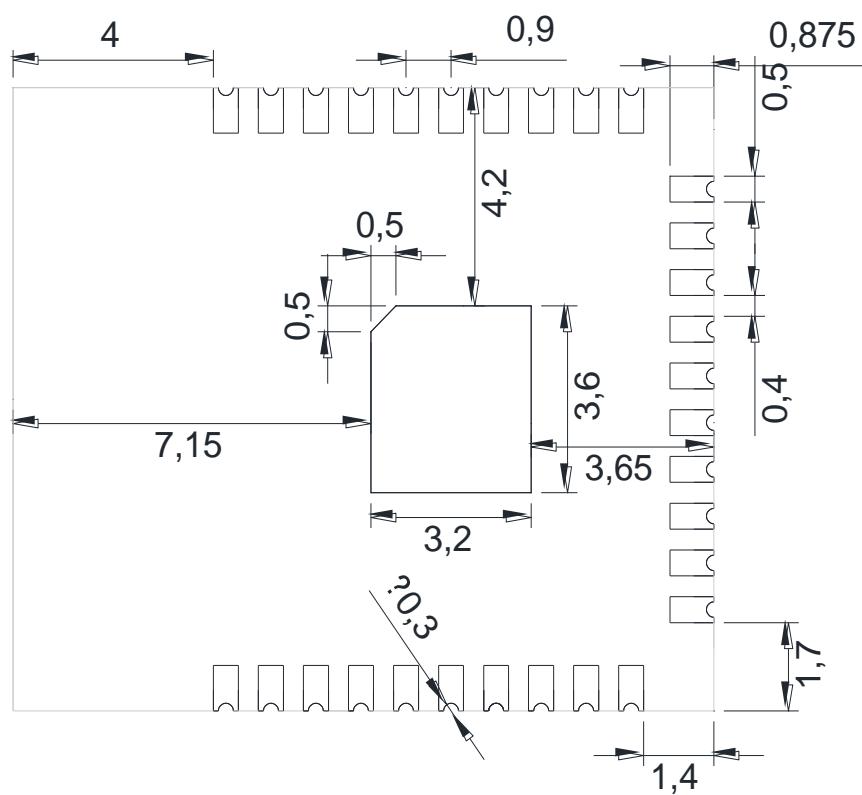
### 8.2 Antenna 3D Radiation Pattern

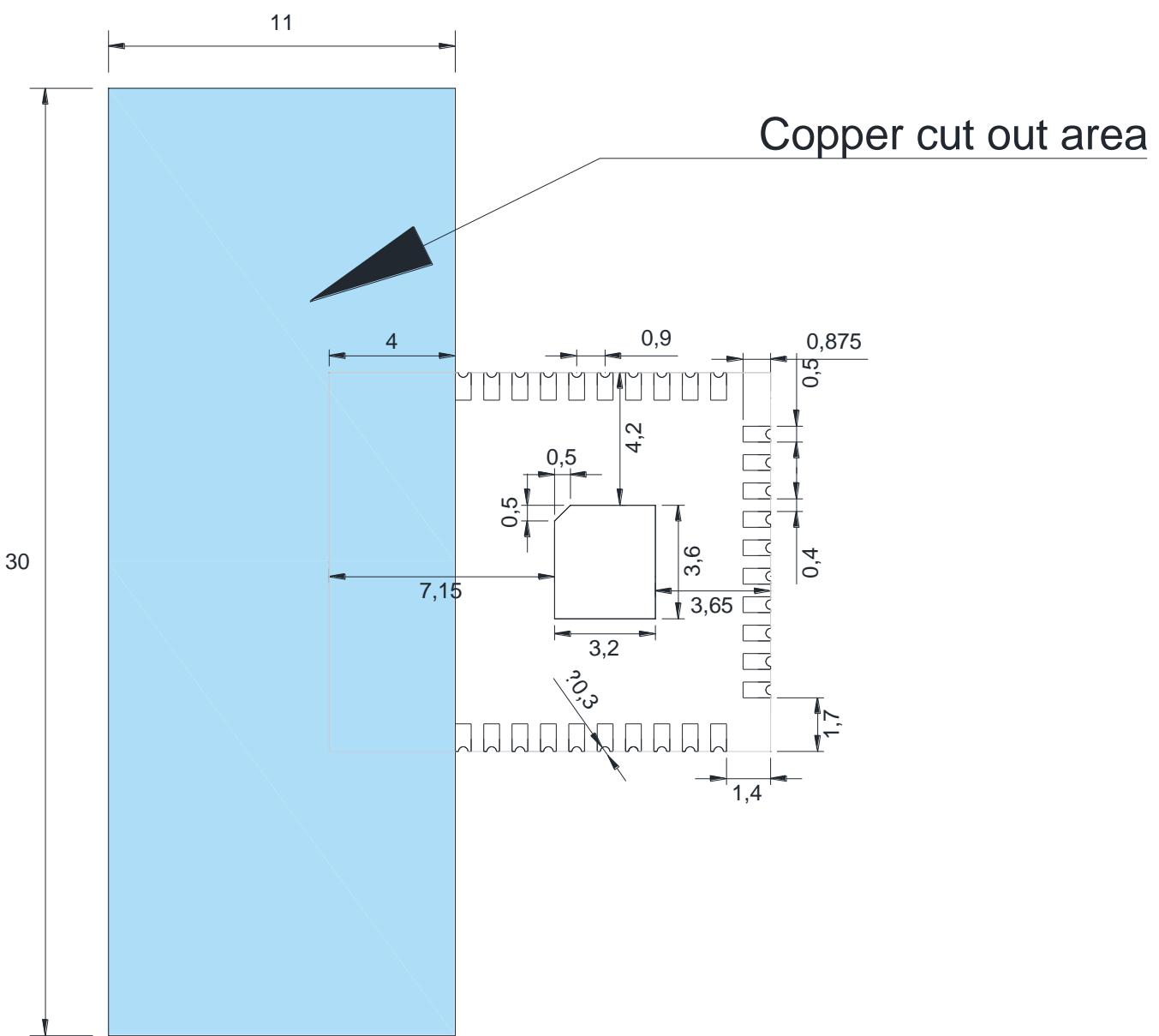


[Top View]

## 9. Mechanical Information





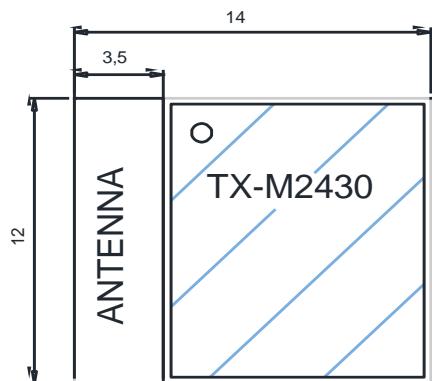


## 10. Reference Peripheral Circuit

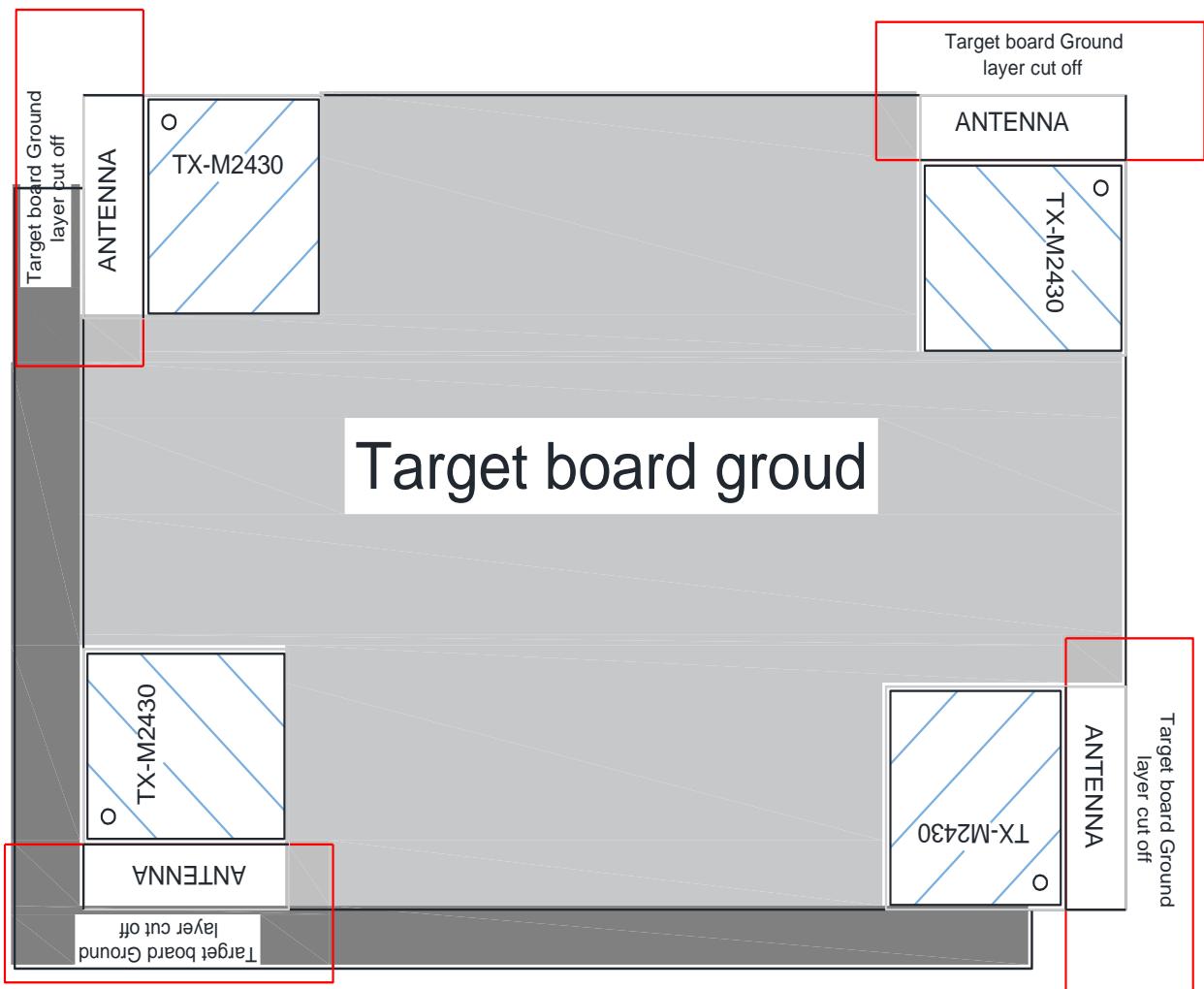
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## 11. Antenna Design Guide

### 11. 1 Antenna Field in Module

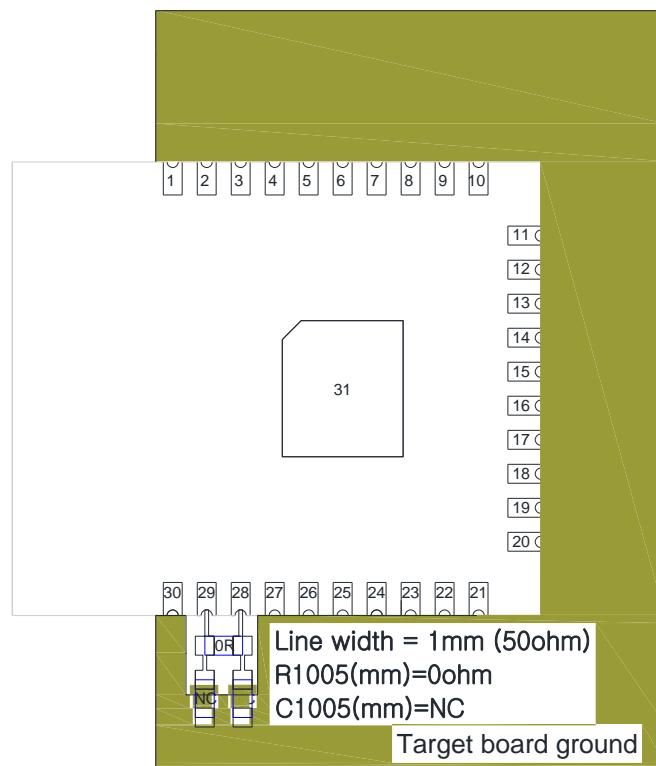


### 11. 2 Module position on Target board



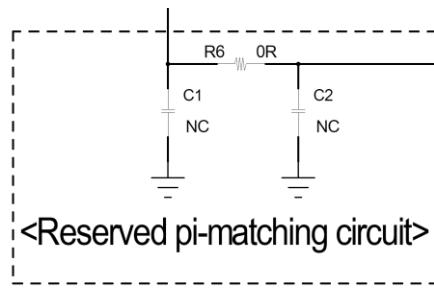
### 11. 3. In case of using the Internal antenna use

- Connect 28 pin(RF) and 29 pin(ANT) as show in figure.



※ TX-M2430 has Optimal antenna inside the module.

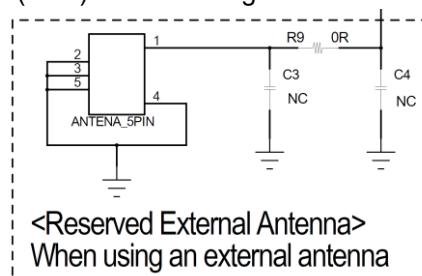
- Place the resistor as close to module as possible to keep a minimum trace distance.
- The default resistor value is 0 ohms. This value would be changed after measuring antenna matching
- Reserved pi-matching can be used to improve the antenna performance in case of connected the target board.



※ See Reference Peripheral Circuit

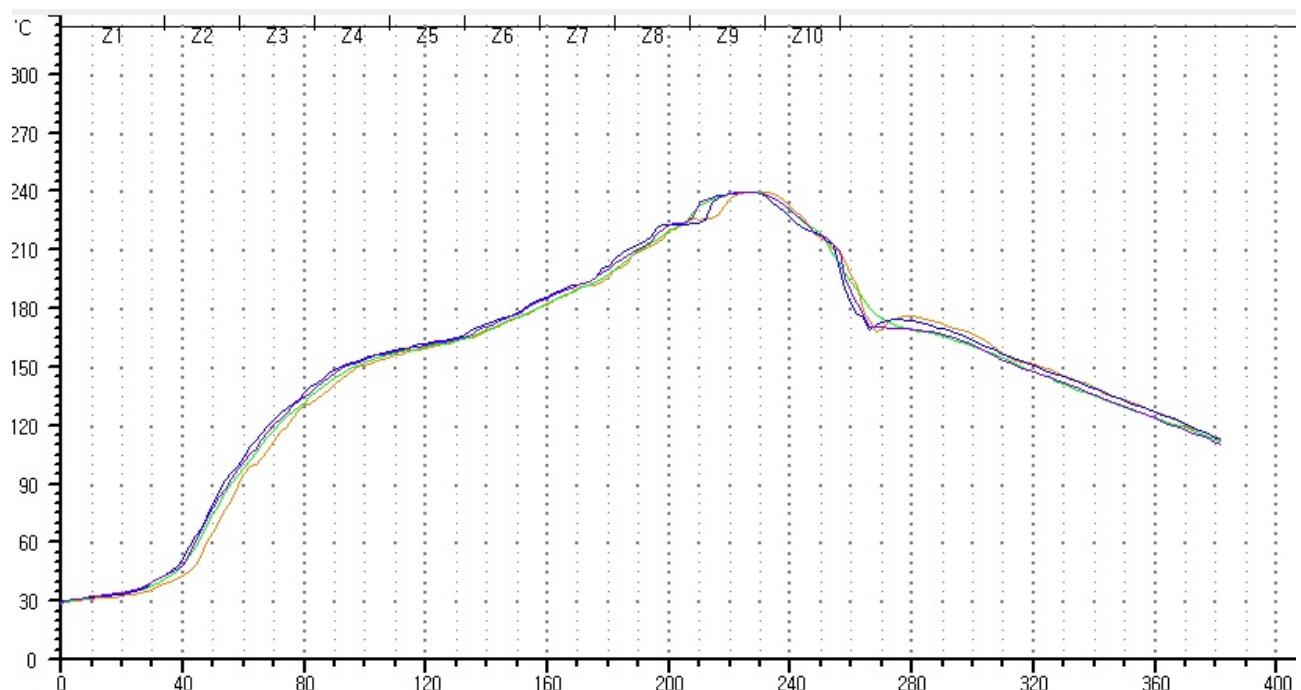
### 11. 4. In case of using the Internal antenna use

- Connect 28 pin(RF) and 29 pin(ANT) as show in figure.



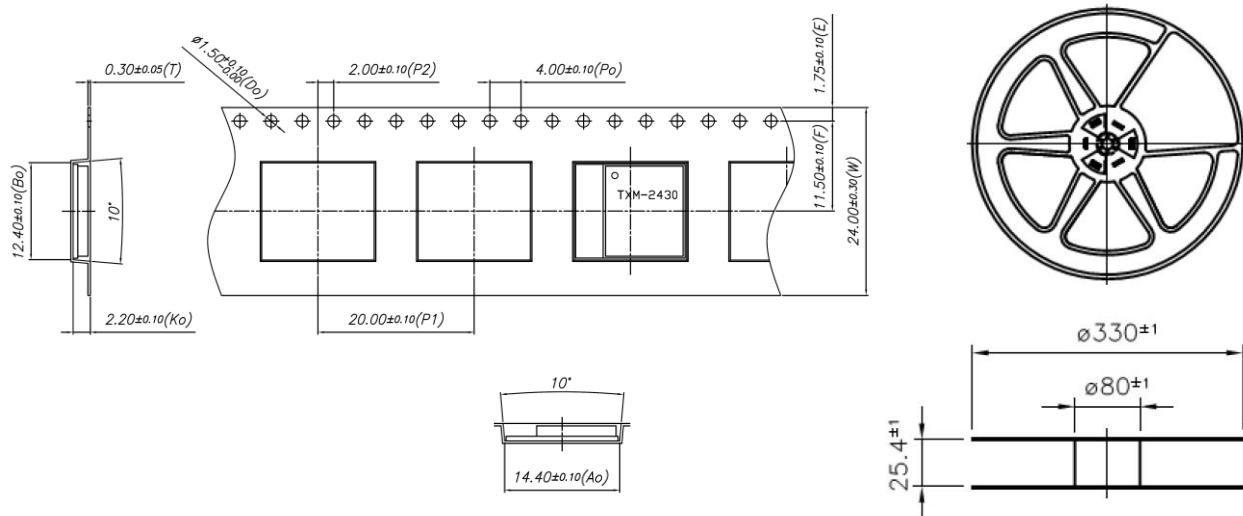
※ See Reference Peripheral Circuit

## 12. SMT Temperature Sequence (Pb-free)

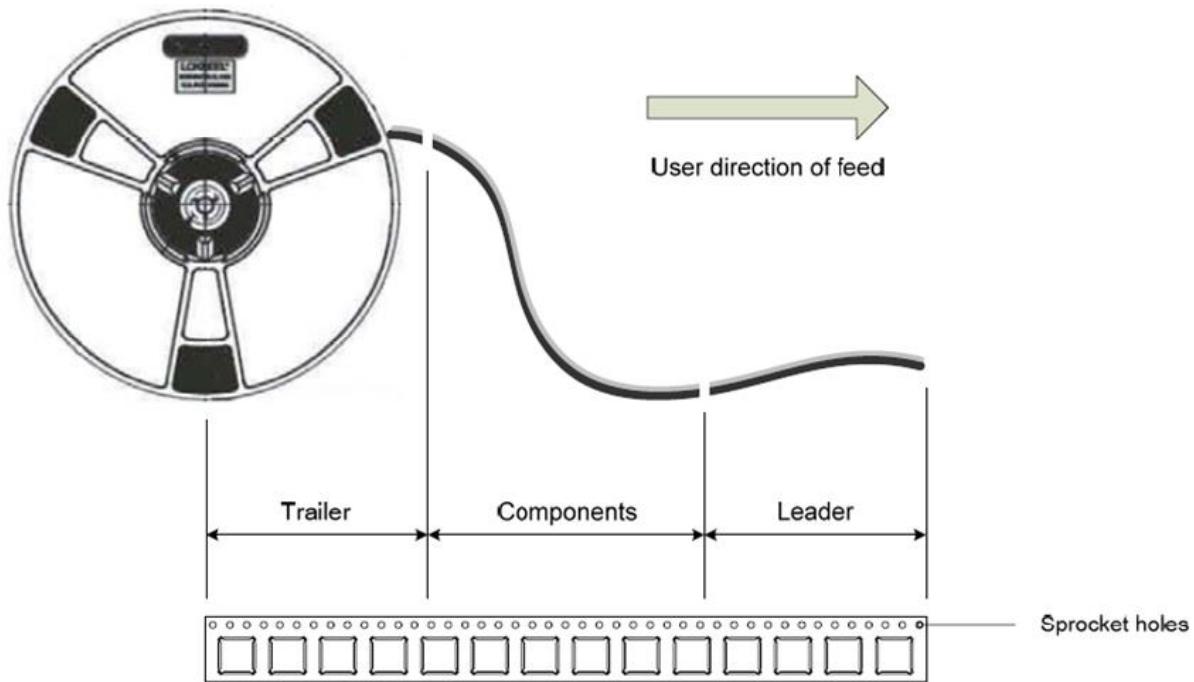


## 13. Packing Information

### 13.1 Carrier Tape and Reel Information



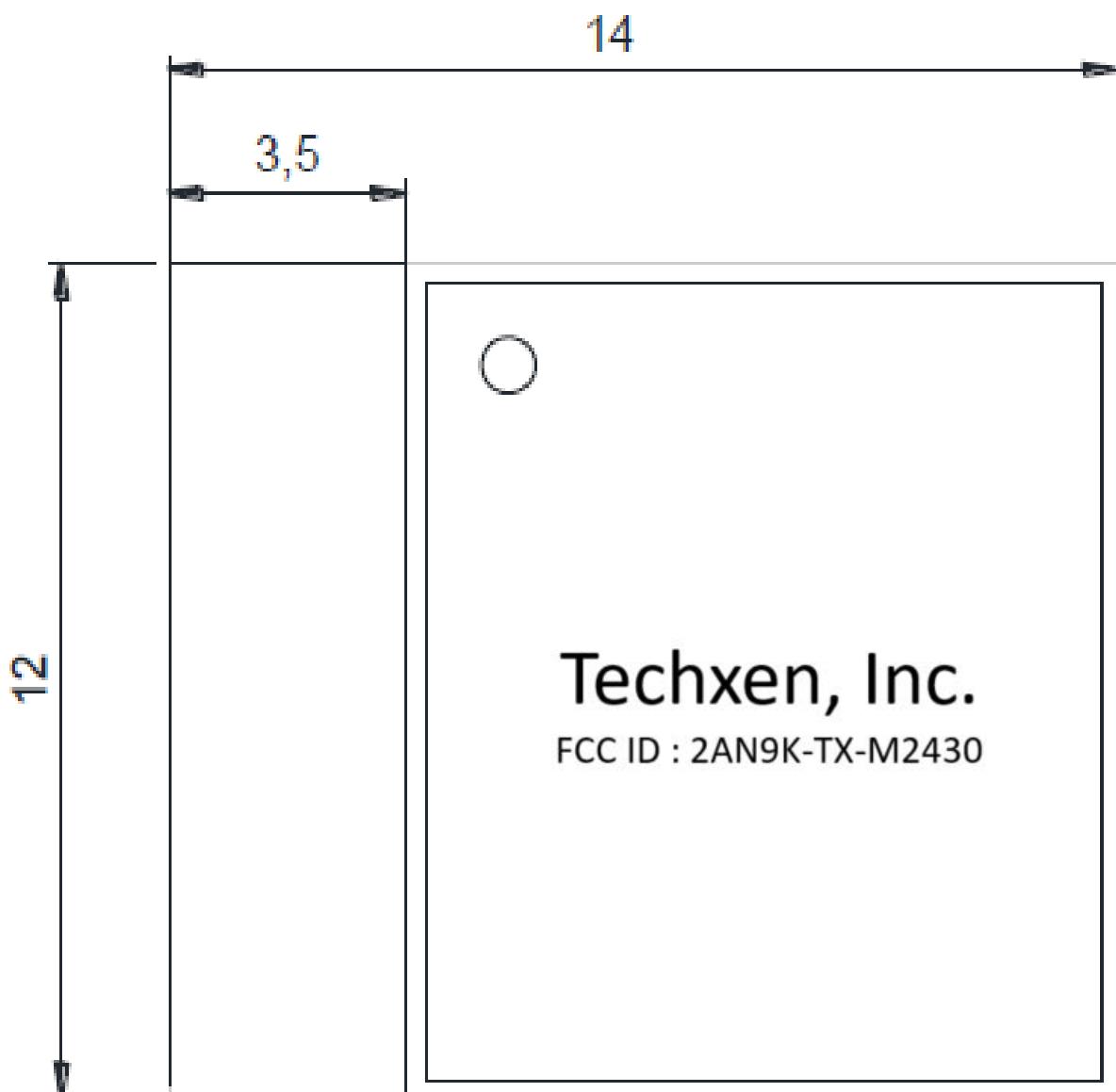
### 13.2 Leader and Trailer length



| Leader<br>(Empty carrier tape) | Components       | Trailer<br>(Empty carrier tape) | Reel / Hub size<br>(mm) |
|--------------------------------|------------------|---------------------------------|-------------------------|
| Min. 500mm                     | 1,400 pcs / Reel | Min. 500mm                      | 330 / 25.4              |

## Appendix: FCC Statement and Label Information

### Label Information



# Appendix: I FCC Statement and Label Information

## FCC Statement

### **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.

**FCC Caution:** 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.

## Appendix II : OEM/Integrators Installation Manual

### OEM Responsibilities to comply with FCC

1. The module has been certified for integration into products only by OEM integrators under the following condition: The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multitransmitter product procedures. The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.
2. In the event that these conditions cannot be met, then the FCC authorizations are 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 this module and obtaining separate FCC authorizations.
  - This device is intended only for OEM integrators
  - For OEM integration only – device cannot be sold to general public.
  - 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.
3. The module is labeled with its own FCC ID. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:  
"Contains FCC ID: 2AN9K-TX-M2430"
4. TX-M2430 is a limited single-modular transmitter that complies with the § 15.212(a)(1) modular rules which requires the host operating condition as below:  
The host device of this module should supply the regulated power of 3.3V to TX-M2430.