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Yanzi stamp - Dual Band Radio Module IEEE 802.15.4, 2.4GHz & 868/915MHz (Silabs EFR32BG13 & TI CC1200)

Yanzi stamp is a low energy radio module designed for next generation of Yanzi wireless IoT sensors.

The single board, solder on, pre-certified radio module combined with Yanzi stack provides a complete IoT solution to build energy efficient wireless sensors while reducing time to market.

Yanzi stamp applications include
- IoT sensors and end devices
- IoT access point and gateway
- Office and building automation

Key features

- Dual band radio module in 20 mm x 40 mm package,
- Certified for 2.4GHz short range operations in EU, UK, USA, and Canada.
- Certified for 868 MHz long range operation in the EU and UK
- Certified for 915MHz long range operations in the USA and Canada.
- On board 2.4GHz chip antenna.
- U.FL. connector for installation of external 868/915MHz balanced antenna.
- 32-bit ARM® Cortex®-M4 core with 40 MHz maximum operating frequency, Silabs MCU EFR32BG13P732F512GM48
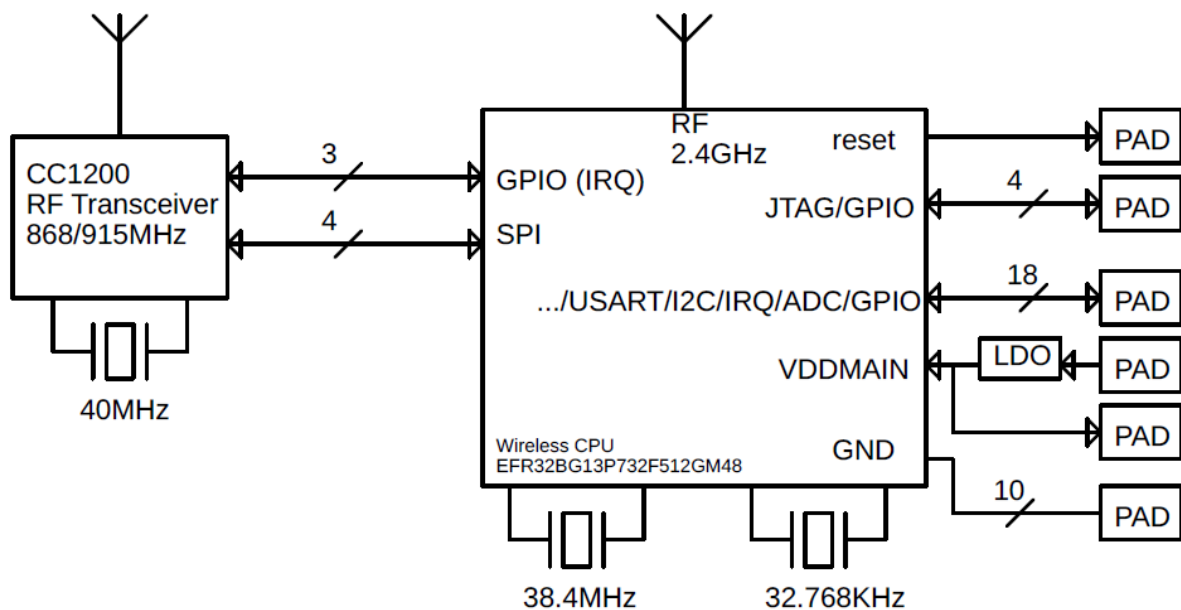- 512 kB of flash and 64 kB of RAM

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Wireless specifications

Wireless low power high density network

- 2405MHz to 2480MHz (2.4GHz), 250kbps, QPSK, IEEE 802.15.4 compliant IPv6 Sensor network with mesh technology
- Modulation QPSK, sensitivity: -85dBm, CCA threshold -75dBm
- Supported channels 11 to 26, channel width 5000KHz
- Wireless Output Power 0dBm to 10 dBm*
- Wireless Range 5 to 25m indoor, (Indicative) **
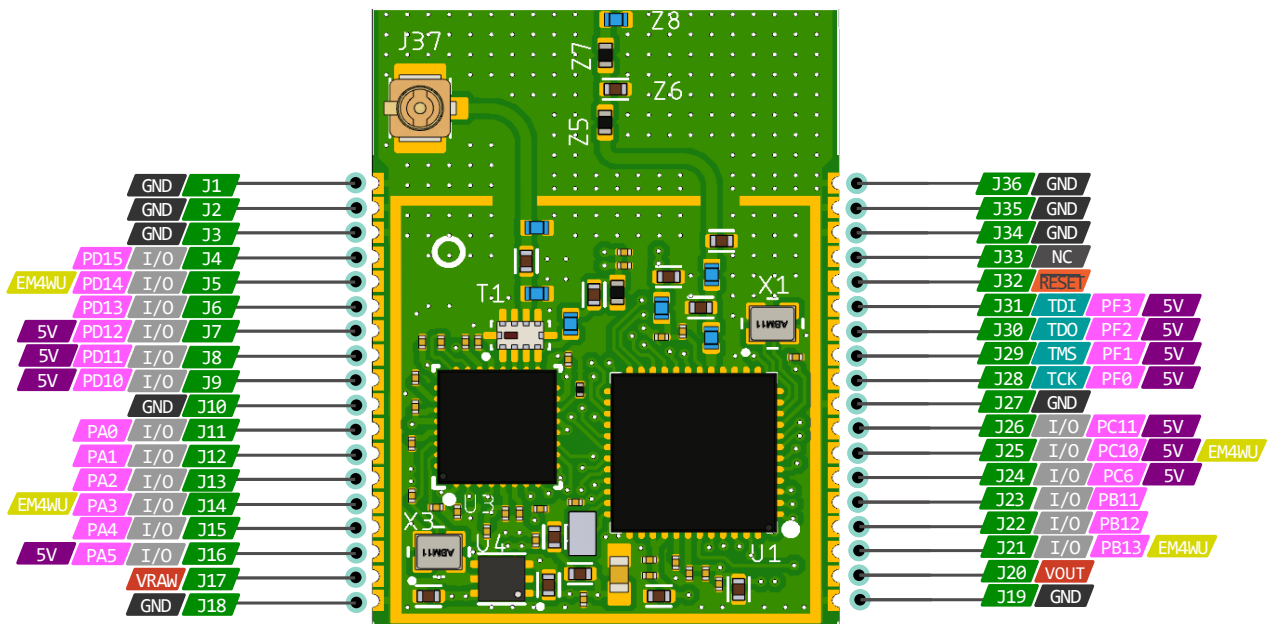- Omnidirectional PCB mount chip antenna with 2.2dBi gain

Wireless low power long range network

- 863MHz to 870MHz (868MHZ Europe), 50kbps, 2-GFSK, IEEE 802.15.4g compliant, ETSI Standard, IPv6 sensor network.
- 902MHz to 928MHz (915MHz North America), 50kbps, 2-GFSK, IEEE 802.15.4g compliant, ARIB Standard, IPv6 sensor network
- 868MHz channel width 25KHz, 915MHz channel width 200KHz
- Sensitivity -109dBm, CCA threshold -82dBm
- Wireless Output Power 0dBm - 14dBm*
- Wireless Range 50 to 100m indoor (Indicative) **
- U.FL/IPEX external antenna connector

* Actual output power depends on regional regulations
** Actual range depends on walls, obstacles, radio disturbances, etc.

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Pin out diagram

For more detail understanding of the pin function please refer to the Silabs EFR32BG13 series datasheet.

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Mechanical layout

Units are in mm. Dimension tolerance +/- 0.2 mm

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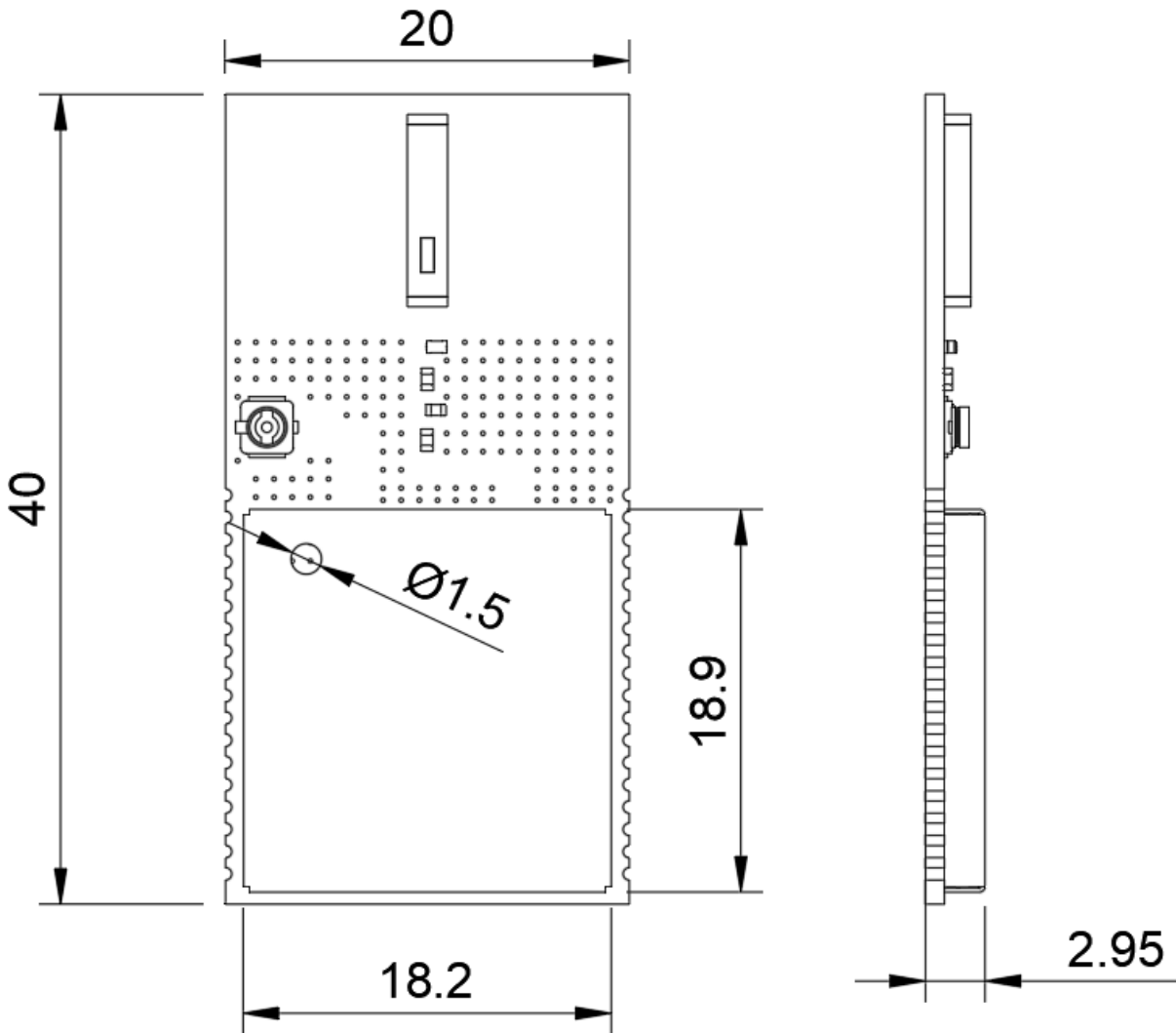
Recommended footprint layout

Pad layout
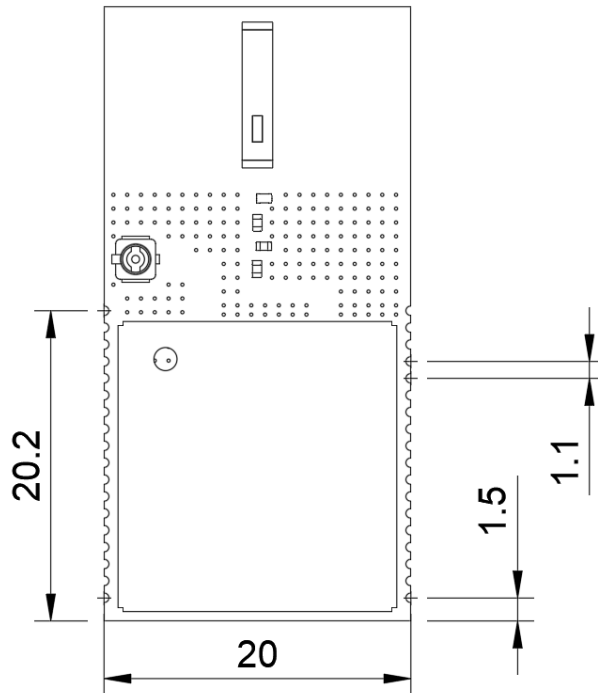
Units are in mm. Dimension tolerance +/- 0.05 mm

Pad dimension

Units are in mm. Dimension tolerance +/- 0.05 mm

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Yanzi stamp radio module images

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Electrical specifications

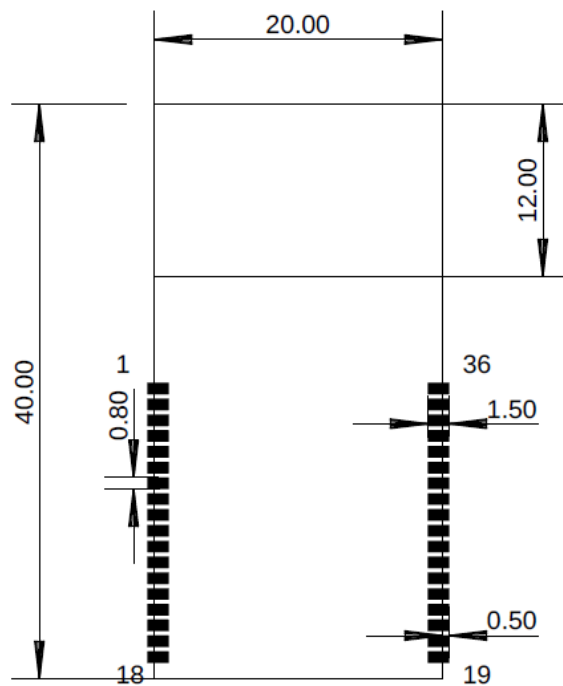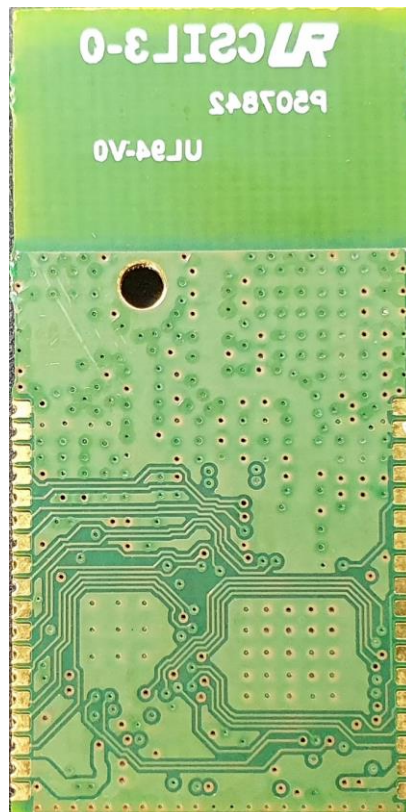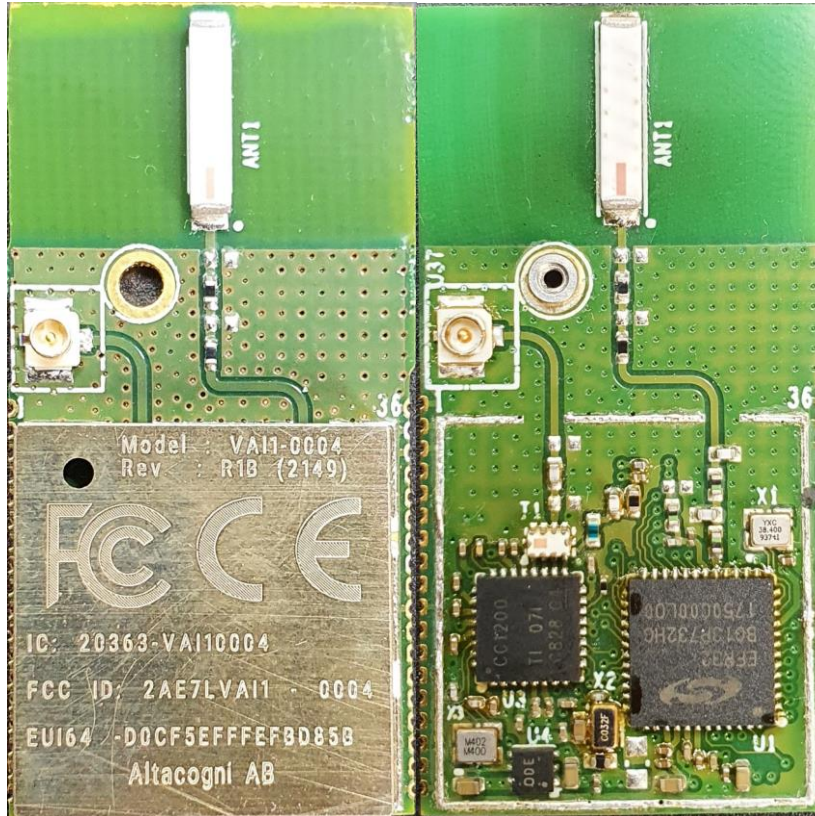- Yanzi stamp has an onboard low dropout (LDO) voltage regulator which provides regulated voltage to the onboard MCU and Sub-GHz radio SoC. The output of the same voltage regulator can also be found between J20 (VDD-OUT) and J19 (GND) pin. The regulated output voltage can be from 3.0 to 3.3Volt depending upon the type of LDO used.
  - Key features of the regulator used (**TPS78230DRV** OR **ADP165ACPZN-3.3)**
    - Input voltage range between J17(VDDRAW) & J18(GND) 2.2 to 5.5 V
    - Max operating load current: 150mAmp
    - Low quiescent current 500nAmp
    - Dropout/pass through mode
    - Low dropout 130 mV @ 150mAmp
    - Thermal shutdown and overcurrent protection
  - For more information, please refer the LDO part datasheet

Power supply recommendation

- It is recommended to put 10uF, >= 6Volt ceramic decoupling capacitors between supply pin 17(VDDARW),18(GND) and 19(VDD-OUT), 20(GND) as close to the module's pins as possible.
- Do not to use the output of the voltage regulator for load more than 20mAmps

Operating and storage requirements

- Operating requirements +5°C to +40°C, 20 - 80% RH (non-condensing)
- Storage Requirements 0°C to +50°C, 20 - 80% RH (non-condensing)

Antenna specifications

- The 2.4GHz radio uses onboard chip antenna (Johanson technology **2450AT45A100E**) in vertical mount position. The gain of the antenna in this position is 2.2dBi typ. The on-board PA for 2.4GHz radio can produce max power of 19dBm (80 mWatt) while the antenna's max input power can be up to 3Watts. For more information, please refer to the device datasheet.
- The Sub-GHz external antenna must be U.FL. connector compatible and must be a dipole type antenna.
- The tested and recommended sub-GHz antenna for 868 and/or 915MHz operations are shown below.
- Molex's **105262 series**. flexible dipole antenna.
  - Peak Gain parameters: 868MHz 0.4dBi, 915MHz 1.4 dBi.
  - Max input power 2 Watts.

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- Molex's **206764 series** flexible dipole antenna.
  - Peak Gain parameters: 868MHz 1.2dBi, 915MHz 1.2dBi
  - Max input power 2 Watts

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2.4 GHz chip antenna S-parameters and radiation patterns

Calibration plane is at the location of feeding port

Return loss of WLAN Antenna
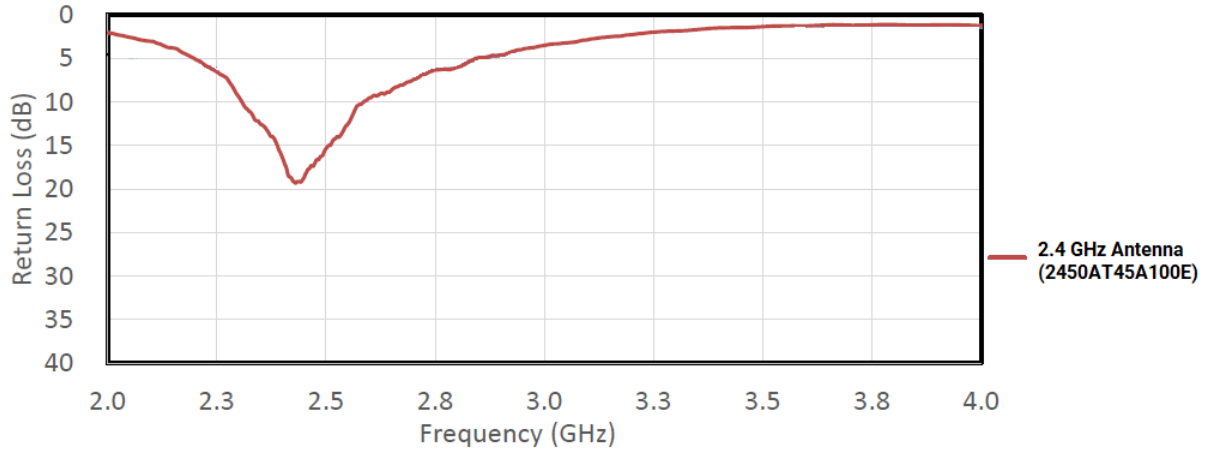
@2.4GHz 16.4 dB and @2.5GHz 15.3dB

Realized efficiency
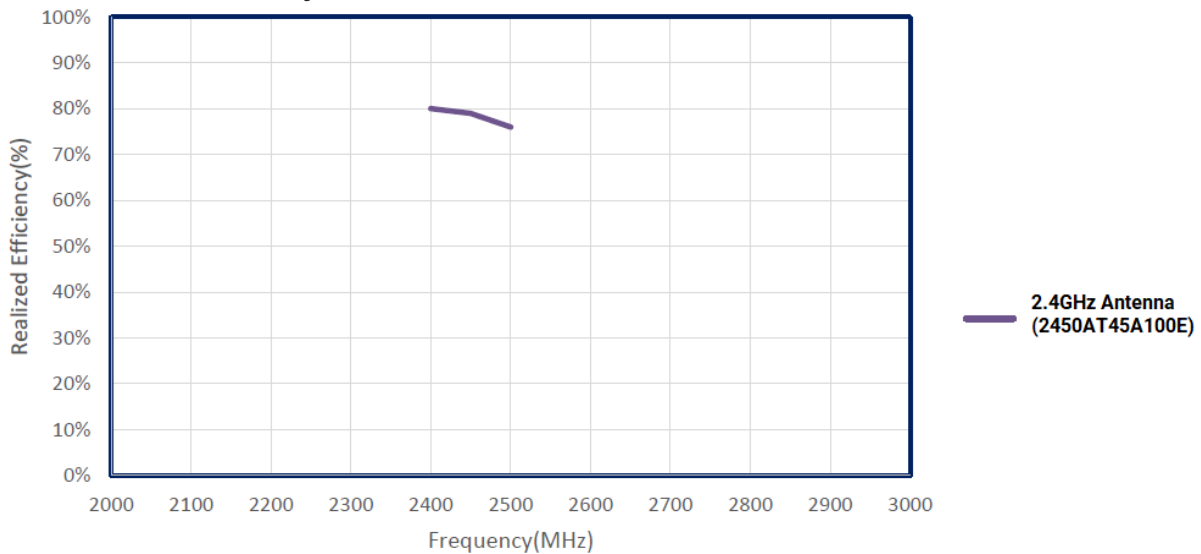
@2.4GHz 80%, @2.45GHz 79%, @2.5GHz 76% Avg:74%

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Peak realized gain
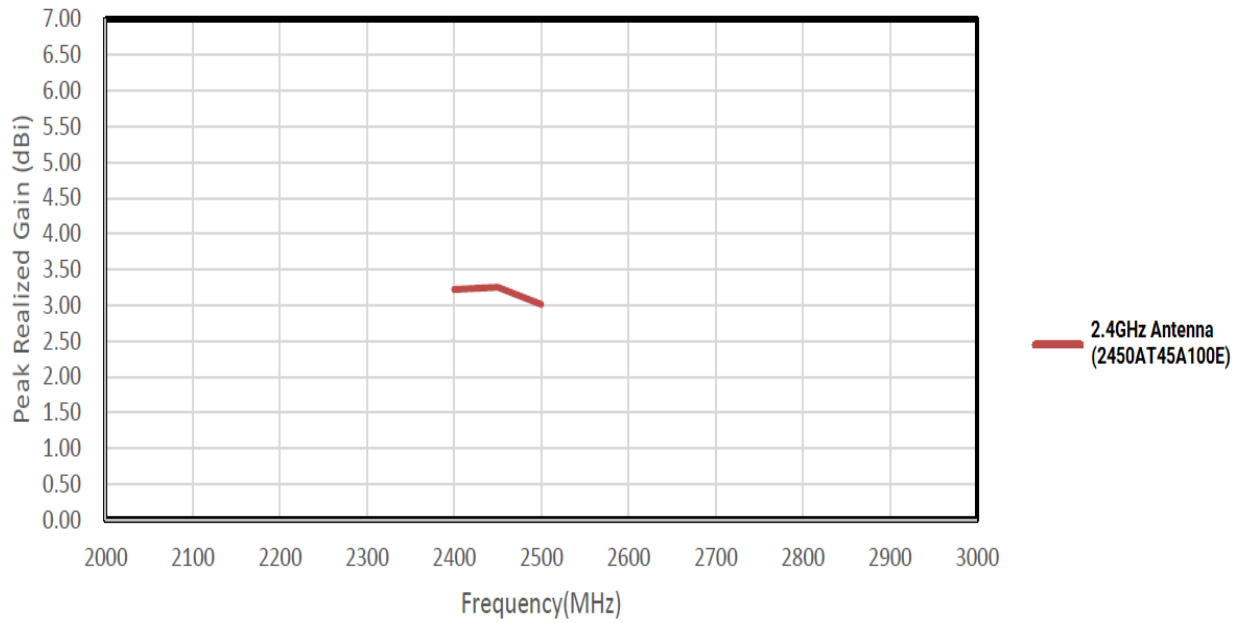
@2.4GHz 3.22dBi, @2.45GHz 3.25dBi, @2.5GHz 3.01dBi

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Radiation pattern visualization

Orientation of the DUT
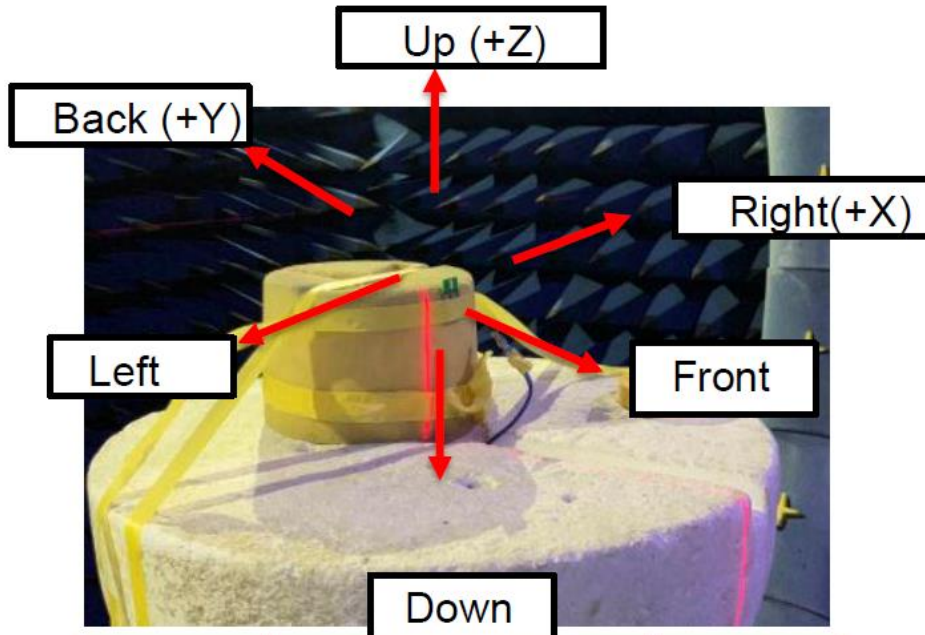
	XZ	YZ	XY
0	Up	UP	Right
90	Right	Back	Back
180	Down	Down	left
270	left	Front	Front

yanzi
ALTACOGNI

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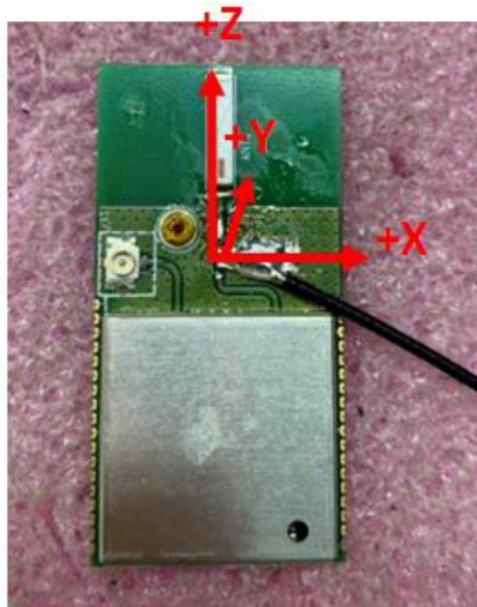
Total gain patterns in principal planes

Azimuth(XY)

2400MHz   2450MHz   2500MHz

Side to Side(XZ)

2400MHz   2450MHz   2500MHz

Front to Back(YZ)

2400MHz   2450MHz   2500MHz

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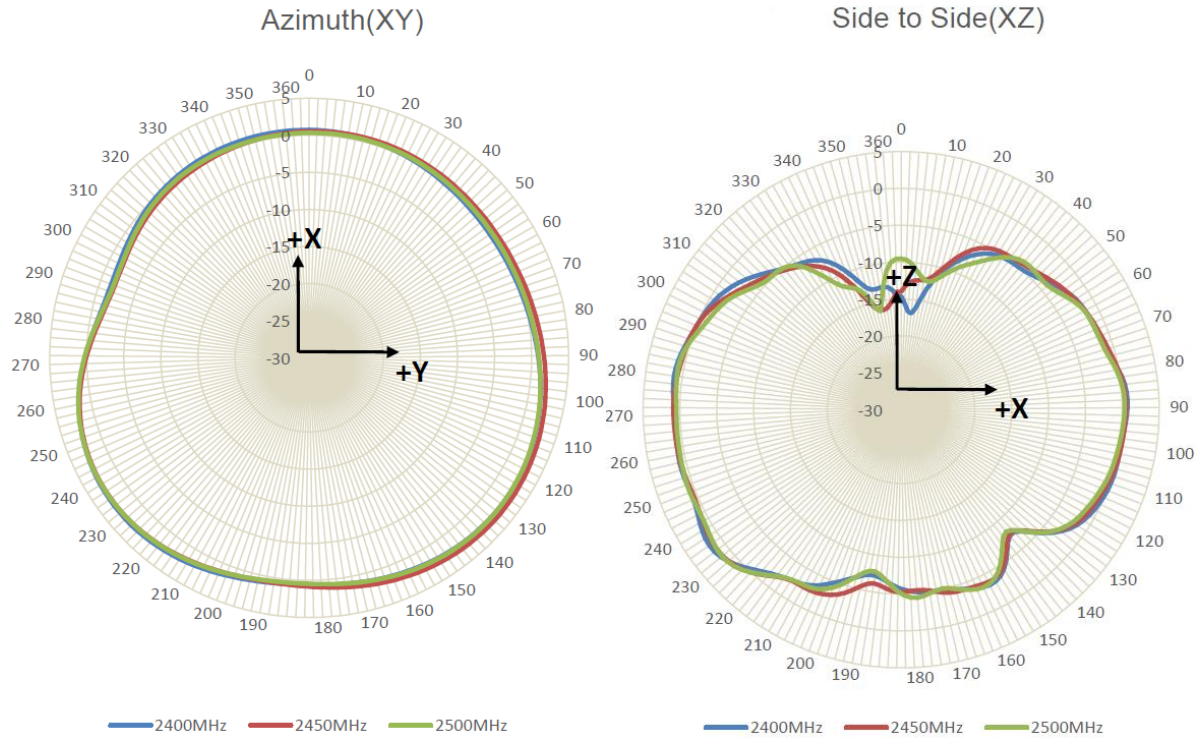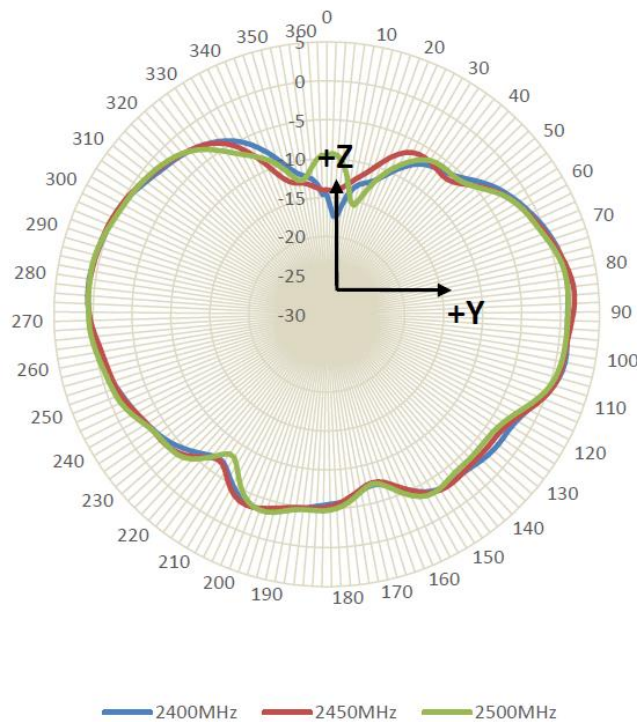
Layout and general design recommendations

- While designing the PCB using Yanzi stamp module make sure to keep all the layers beneath the 12mm of 2.4GHz antenna area free of any planes or traces.
- Avoid routing on the first (top) layer of the PCB laying under the Yanzi stamp PCB area.
- It is important to keep ground planes and any isolated metal parts (such as screws) away from both 2.4GHz and sub-GHz antennas.
- Antenna facing outwards and facing away from wall is preferred while designing the product.
- It is always a good idea to keep the polarization of antenna equal between the sensor products and the access point or gateway for best performance although it is not a must.
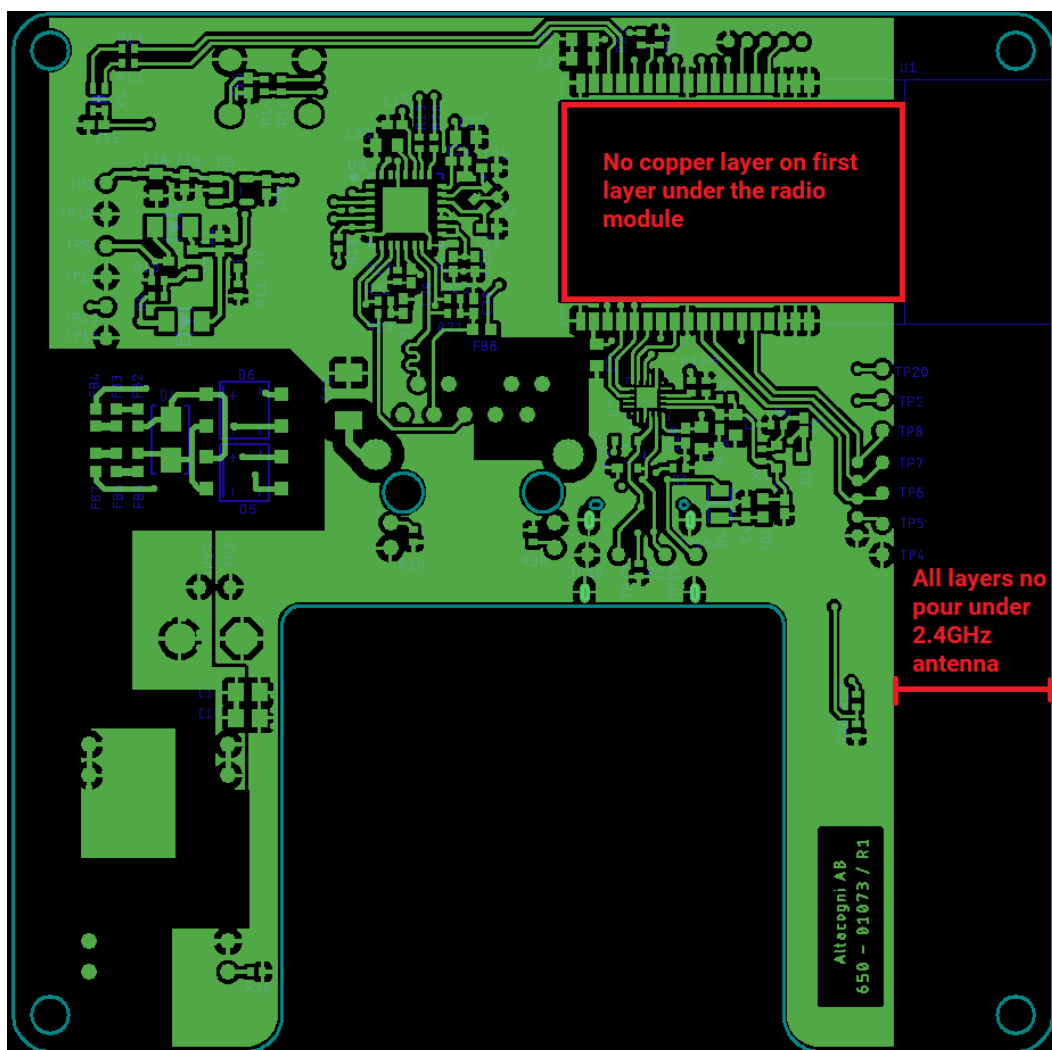
An example board using the Yanzi stamp (VAI1-0004) radio module

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Host Product verification and testing

The host product must be designed to be integrated with Yanzi system using Yanzi proprietary firmware stack (IEEE 802.15.4 + IPV6).

The label on the host product must include the 8-digit alpha-numeric EUI64 printed on the Yanzi stamp in the form of a plain text and a QR code.

For functional testing of the host product, one will require a **Yanzi Gateway** connected to an active internet connection using an ethernet port on the gateway. The testing of the new host product/sensors can be done using Yanzi Lifecycle portal on live.yanzi.cloud . Using life cycle tool one can discover and pair the host product/sensors to the gateway using the unique EUI64 code engraved/adhered on Yanzi stamp module. Upon sccessful pairing the host sensor should start transferring data with the Yanzi Gatway each activity cycle (usually every 2 minutes). For more deatils on the installation and Yanzi Lifecyle tool please refer to "installation-manual-890-03084-smart-office-en.pdf" document also available at yanzi.dev/user-manual/.

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Certification and compliance information

Model number: **VAI1-0004**
Revision: **R1B**

FCC Information

- FCC ID: **2AE7LVAI1-0004**
- Warning: Changes or modifications to this unit not expressly approved by Altacogni AB for compliance could void the user's authority to operate the equipment.
- This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- 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 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

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Industry Canada statement

- IC ID: **20363-VAI10004**
- This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(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.
- L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
  1) L'appareil ne doit pas produire de brouillage;
  2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CE

- Yanzi stamp complies with the Essential Requirements of RED (Radio Equipment Directive) of the European Union (2014/53/EU). Yanzi stamp meets the ETSI 300 328 V2.2.2 and ETS 300 220 V3.2.1 conformance standards for radio performance.

Compliance marking for FCC and Industry Canada

- Yanzi stamp modules are FCC and IC certified radio modules that carries a "Modular" grant. Yanzi stamp radio modules comply with the "Intentional Radiator" portion (Part 15c) for FCC certification.
- The host product, incorporating a Yanzi stamp module will require additional compliance testing to any other FCC rules that may apply to the host not covered by the modular transmitter grant certification.
- For other local compliance regulations (CE, UL etc.) the host product manufacturer is responsible to ensue all required compliance testing is completed.
- The integrator is responsible for the final compliance of the end product including this certified transmitter module.

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OEM equipment labeling requirements

WARNING: The OEM must ensure that FCC and IC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Altacogni AB FCC and IC identifier for this product as well as the FCC notice below. In case if the said notice cannot be placed on the product due to size constraints, it must be specified in the user manual of the product.

Contains FCC ID: 2AE7LVAI1-0004
Contains IC ID: 20363-VAI10004

The enclosed 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.

The label on the host product must include the 8-digit alpha-numeric EUI64 printed on the Yanzi stamp in the form of a plain text and a QR code.

Warning required in OEM manuals

WARNING: This equipment has been approved for mobile applications where the equipment should be used at distances greater than 7.87 in (20 cm) from the human body. Operation at distances of less than 7.87 in (20 cm) is strictly prohibited and requires additional SAR evaluation.

Antenna requirements

To reduce potential radio interference to other users, the antenna type and gain should be chosen so that the equivalent isotopically radiated power (EIRP) is not more than that permitted for successful communication. Refer to recommended antenna section for more details.

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