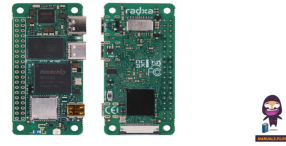**Manuals+** — User Manuals Simplified.

radxa ZERO 3W A Light Compact and Tiny SBC

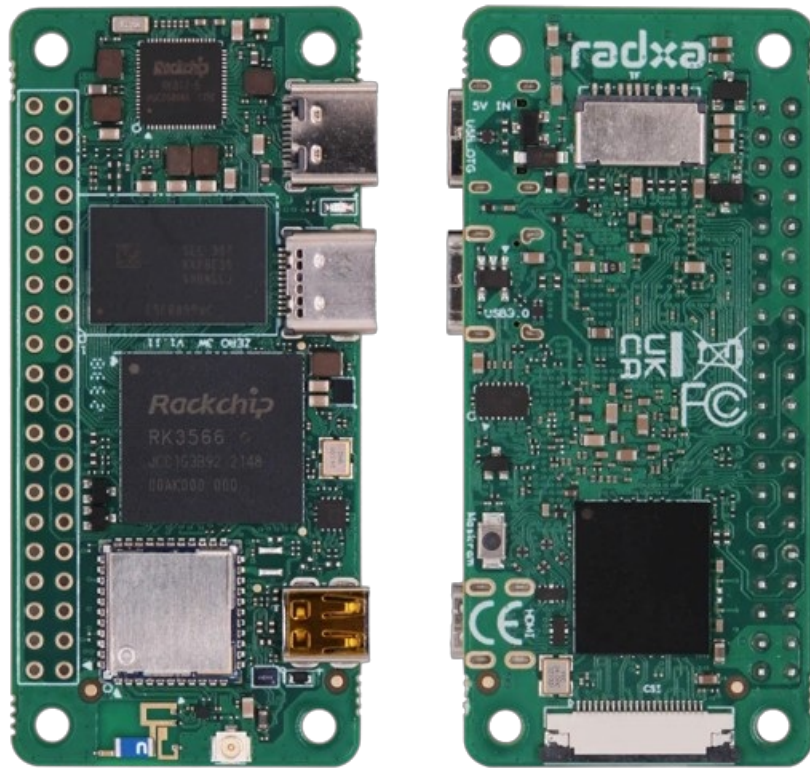# radxa ZERO 3W A Light Compact and Tiny SBC Owner's Manual

Contents

radxa ZERO 3W A Light Compact and Tiny SBC

Specifications

- Product: Radxa ZERO 3W
- Revision: 1.6
- Date: 2023-11-15
- Manufacturer: Radxa Computer (Shenzhen) Co., Ltd.

Product Information

Features

- **Hardware:**
  - Display via Micro HDMI
  - H.264/H.265 decoder up to 4K@60fps
  - H.264/H.265 encoder up to 1080P@60fps
- **Interfaces:**
  - IEEE 802.11 a/b/g/n/ac/ax (WiFi 6) and BT 5.4 with BLE
  - Onboard or External Antenna Configured by Software
  - 1x TF Card Slot
  - 1x Micro HDMI ports supporting displays up to 1080P@60fps
    resolution
  - 1x USB2 OTG Type C port for power and data
  - 1x USB3 HOST Type C port
  - 1x MIPI CSI
  - 40x user GPIO supporting various interface options
- **Software:**
  - ARMv8 Instruction Set

- Debian/Ubuntu Linux support
- Hardware access/control library for Linux

Mechanical Specification

The mechanical specifications of the Radxa ZERO 3W are detailed in the product documentation.

Electrical Specification

- **Power Requirements:**
  - The Radxa ZERO 3W supports DC +5V voltage.
  - Power adapter with 5V/1A on the USB 2.0 OTG TypeC power port
  - 5V Power from the GPIO PIN 2 & 4

Peripherals

The Radxa ZERO 3W offers GPIO expansion and compatibility with various accessories on the market.

Product Usage Instructions

Setting Up the Radxa ZERO 3W

1. Connect the power adapter to the USB 2.0 OTG TypeC power port.
2. If needed, insert a TF card into the designated slot.
3. Connect a display using the Micro HDMI port.
4. You can now power on the device and start using it.

GPIO Interface Usage

The GPIO interface of the Radxa ZERO 3W can be used for various purposes such as connecting external devices, sensors, or peripherals. Refer to the product documentation for GPIO pin mappings and usage instructions.

FAQ

- **Q: What operating systems are supported by the Radxa ZERO 3W?**
  - A: The Radxa ZERO 3W supports Debian/Ubuntu Linux.
- **Q: What is the power requirement for the Radxa ZERO 3W?**
  - A: The device requires a DC +5V voltage, which can be supplied via a power adapter with 5V/1A or through the GPIO PIN 2 & 4.

Revision Control Table

Version	Date	Changes from previous version
1.0	14/03/2022	First version
1.1	14/07/2023	Update Images
1.2	01/08/2023	Update Information
1.3	22/08/2023	Improve readability
1.4	24/08/2023	Add SKU models
1.5	13/10/2023	Update Images and Info
1.6	15/11/2023	Update Images, Info and SKU

Introduction

The Radxa ZERO 3W is a high-performance Single Board Computer (SBC) engineered in a compact form factor, designed to deliver unparalleled computational capabilities while maintaining exceptional mechanical compatibility. Tailored for a diverse user base, including makers, IoT developers, hobbyists, and PC DIY enthusiasts, the Radxa Zero 3W serves as a robust and versatile platform. It is optimized for the development, prototyping, and deployment of various applications, thereby providing a reliable foundation for translating innovative ideas into functional realities.
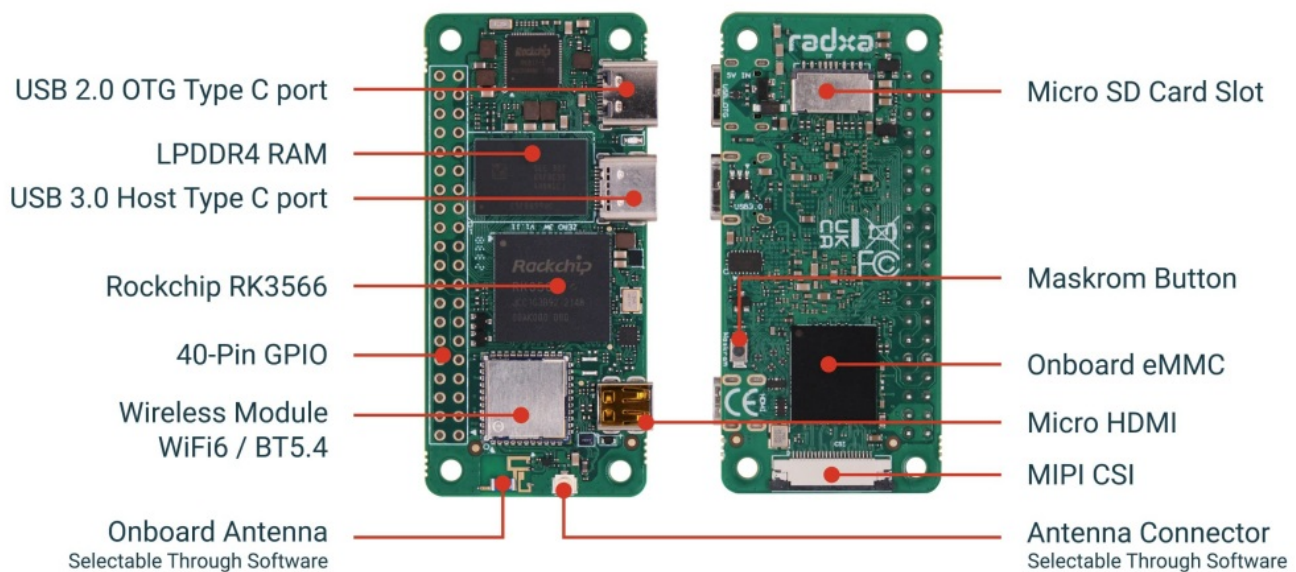
Note:

The images presented depict a particular configuration of the Radxa ZERO 3W. Please note that the actual component layout and specifications may differ based on the selected Stock Keeping Unit (SKU).

Features

Hardware

- Rockchip RK3566 SoC

- Quad-core Arm® Cortex®-A55 (ARMv8) 64-bit @ 1.6GHz
- Arm Mali™-G52-2EE, OpenGL® ES1.1/2.0/3.2, Vulkan® 1.1, OpenCL™ 2.0
- 1GB / 2GB / 4GB LPDDR4 RAM
- Optional Onboard eMMC Module 8GB / 16GB / 32GB
- Display via Micro HDMI
- H.264/H.265 decoder up to 4K@60fps
- H.264/H.265 encoder up to 1080P@60fps

Interfaces

- IEEE 802.11 a/b/g/n/ac/ax (WiFi 6) and BT 5.4 with BLE
- Onboard or External Antenna Configured by Software
- 1x TF Card Slot
- 1x Micro HDMI ports supporting displays up to 1080P@60fps resolution
- 1x USB2 OTG Type C port for power and data
- 1x USB3 HOST Type C port
- 1x MIPI CSI
- 40x user GPIO supporting various interface options:
    - up to 5 x UART
    - 1 x SPI bus
    - up to 2 x I2C bus
    - 1 x PCM/I2S
    - up to 6 x PWM
    - up to 28 x GPIO
    - 2 x 5V DC power in
    - 2 x 3.3V power pin

Software

- ARMv8 Instruction Set
- Debian/Ubuntu Linux support
- Hardware access/control library for Linux

Specification

Mechanical Specification
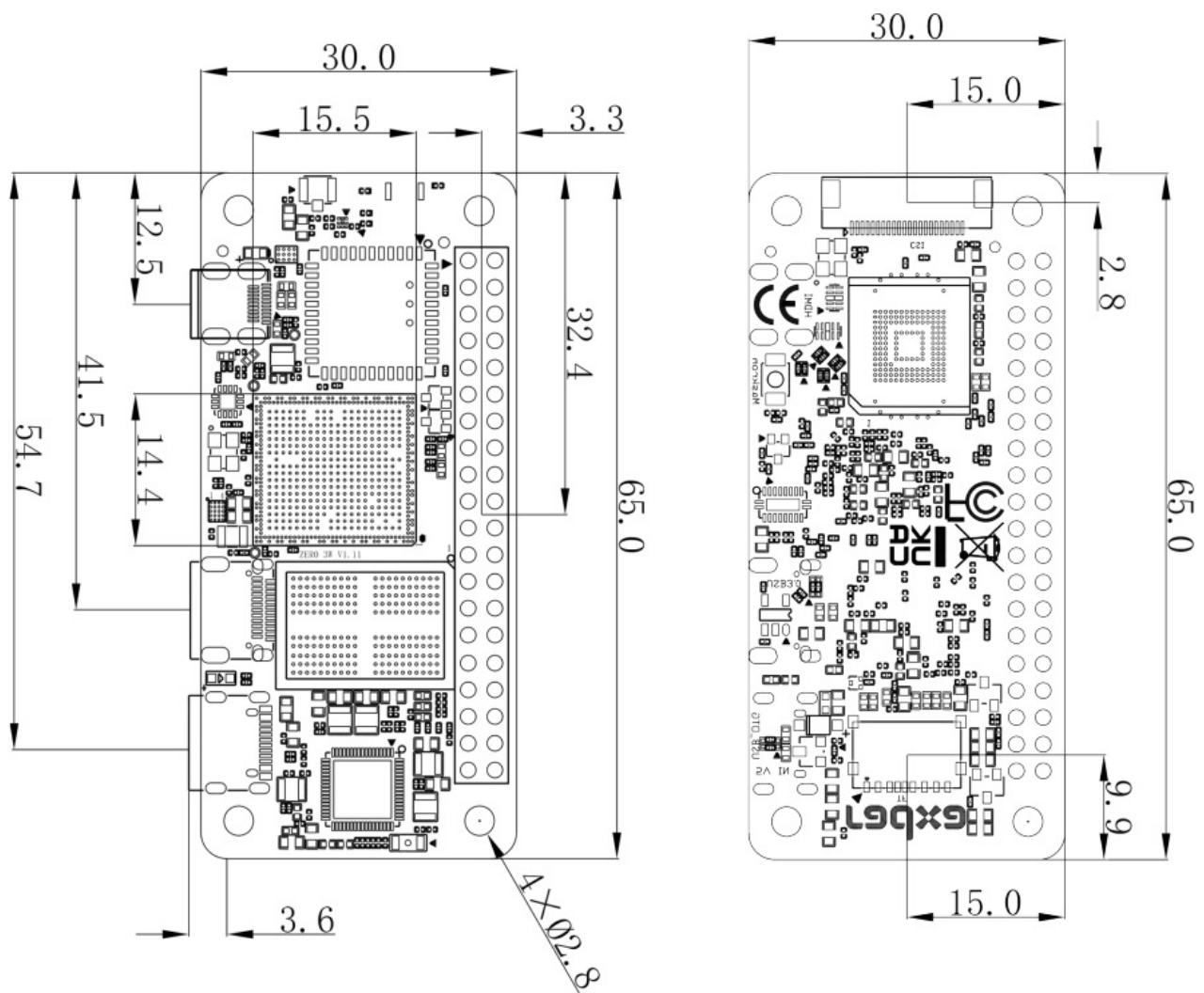
Electrical Specification

Power Requirements

The Radxa ZERO 3W support DC +5V voltage:

- Power adapter with 5V/1A on the USB 2.0 OTG Type-C power port
- 5V Power from the GPIO PIN 2 & 4

Peripherals

GPIO Interface

Radxa ZERO 3W offers 40P GPIO expansion which is compatible with many accessories on the market.

GPIO Alternate Functions

Function5	Function4	Function3	Function2	Function1	Pin#	Pin#	Function1	Function2	Function3	Function4	Function5
				+3.3V	1	2	+5.0V				
		I2C3_SDA_M0	UART3_RX_M0	GPIO1_A0	3	4	+5.0V				
		I2C3_SCL_M0	UART3_TX_M0	GPIO1_A1	5	6	GND				
	PWM14_M0			GPIO3_C4	7	8	GPIO0_D1	UART2_TX_M0			
				GND	9	10	GPIO0_D0	UART2_RX_M0			
				GPIO3_A1	11	12	GPIO3_A3				I2S3_SCLK_M0
	I2S3_MCLK_M0			GPIO3_A2	13	14	GND				
				GPIO3_B0	15	16	GPIO3_B1	UART4_RX_M1	PWM8_M0		
				+3.3V	17	18	GPIO3_B2	UART4_TX_M1	PWM9_M0		
	PWM15_IR_M1	I2S3_SCLK_M1	SPI3_MOSI_M1	GPIO4_C3	19	20	GND				
UART9_TX_M1	PWM12_M1	I2S3_SDO_M1	SPI3_MISO_M1	GPIO4_C5	21	22	GPIO3_C1				I2S1_SDO2_M2
	PWM14_M1	I2S3_MCLK_M1	SPI3_CLK_M1	GPIO4_C2	23	24	GPIO4_C6	SPI3_CS0_M1	PWM13_M1	UART9_RX_M1	I2S3_SDI_M1
				GND	25	26	GPIO4_D1	SPI3_CS1_M1			
	I2C4_SDA_M0	I2S2_SDI_M1		GPIO4_B2	27	28	GPIO4_B3			I2C4_SCL_M0	I2S2_SDO_M1
				GPIO3_B3	29	30	GND				
				GPIO3_B4	31	32	GPIO3_C2	UART5_TX_M1			I2S1_SDO3_M2
UART5_RX_M1		I2S1_SCLK_RX_M2		GPIO3_C3	33	34	GND				
		I2S3_LRCK_M0		GPIO3_A4	35	36	GPIO3_A7				
		I2S1_SCLK_RX_M0		GPIO1_A4	37	38	GPIO3_A6				I2S3_SDI_M0
				GND	39	40	GPIO3_A5				I2S3_SDO_M0

USB

The Radxa ZERO 3W is outfitted with a USB 3.0 Host Type-C interface, constrained to a maximum electrical current of 500mA in accordance with USB 3.0 specifications. Additionally, the unit incorporates a USB 2.0 OTG (On-The-Go) Type-C port, compatible with a 5V power supply adapter as well as standard USB ports on computing devices such as laptops and desktops. This OTG port serves a dual function: it acts as a programming interface compliant with standard flashing protocols for software updates, and facilitates data access for read/write operations. Its multi-purpose design renders it suitable for a range of applications, including but not limited to, experimental data transfers, debugging, and other specialized tasks

Camera Interfaces

The Radxa ZERO 3W is equipped with a 1×4-lane MIPI CSI (Mobile Industry Processor Interface Camera Serial Interface) connector for camera integration. This interface is designed to be backward-compatible with standard industrial camera peripherals, ensuring seamless integration and operational flexibility.

HDMI

The Radxa ZERO 3W features a single Micro HDMI port, engineered to support Consumer Electronics Control (CEC) and HDMI 2.0 standards. This port is capable of outputting video resolutions up to 1080p at 60 frames per second (1080p60).

Temperature Range and Thermals

The specified ambient operating temperature for optimal performance of the Radxa ZERO 3W ranges from 0°C to 50°C, in accordance with industry standards. To optimize thermal efficiency, the Radxa ZERO 3W employs dynamic voltage and frequency scaling (DVFS). During idle or low-load conditions, the CPU clock frequency and core voltage are dynamically reduced to minimize thermal dissipation. Conversely, under high-load scenarios, both the clock frequency and core voltage are elevated, resulting in increased thermal output. An internal thermal management governor is in place to regulate these parameters, ensuring that the CPU temperature does not exceed a threshold of 85°C. Engineered for burst performance, the Radxa ZERO 3W is capable of operating effectively without additional cooling solutions. It is designed to handle light-to-moderate workloads on average, while having the capability to ramp up CPU performance for more demanding tasks, such as webpage loading. For users intending to subject the system to sustained high-load conditions or operate it in elevated ambient

temperatures at full performance, supplementary cooling mechanisms may be advisable.

Models and SKU

DRAM	eMMC	GPIO Header	SKU
1GB	N/A	Pre-soldered	RS107-D1E0H1W15
		Empty	RS107-D1E0H0W15
	8GB	Pre-soldered	RS107-D1E8H1W15
		Empty	RS107-D1E8H0W15
2GB	N/A	Pre-soldered	RS107-D2E0H1W15
		Empty	RS107-D2E0H0W15
	16GB	Pre-soldered	RS107-D2E16H1W15
		Empty	RS107-D2E16H0W15
4GB	N/A	Pre-soldered	RS107-D4E0H1W15
		Empty	RS107-D4E0H0W15
	32GB	Pre-soldered	RS107-D4E32H1W15
		Empty	RS107-D4E32H0W15
8GB	N/A	Pre-soldered	RS107-D4E0H1W15
		Empty	RS107-D4E0H0W15
	64GB	Pre-soldered	RS107-D4E64H1W15
		Empty	RS107-D4E64H0W15

Availability

Radxa commits to ensuring the availability of the Radxa ZERO 3W model until a minimum date of September 2033, thereby providing long-term support and supply assurance.

Support

For technical support and inquiries, kindly refer to the Hardware Documentation section on the Radxa Documentation website. For further assistance and community discussions, please direct your questions to the Radxa Forum.

FCC Statement

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 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 device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter. 15.105 Information to the user. (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user. The final end product must be labelled in a visible area with the following: "Contain Transmitter Module FCC ID: 2BC6T-ZERO3W" Requirement per KDB996369 D03

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 FCC part 15C(15.247&15.407). 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 has Chip antenna, The antenna gain is:

- BT/2.4G WIFI: 1.5dBi
- 5.1G WIFI: 2.3dBi
- 5.8G WIFI: 2.6dBi
- Radxa

Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer isresponsible 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 single module.

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.

- 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: Yes, The module with Chip antenna designs, and This manual has been shown the layoutof FPC design, antenna, connectors, and isolation requirements.

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, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2BC6T-ZERO3W.

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 has Chip antenna, The antenna gain is below:

- BT/2.4G WIFI: 1.5dBi
- 5.1G WIFI: 2.3dBi
- 5.8G WIFI: 2.6dBi

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: 2BC6T-ZERO3W"

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 stand-alone 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: Can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.
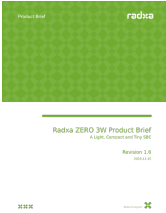
Additional testing, Part 15 Subpart B disclaimer

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 shoule be evaluated by the FCC Subpart B.

Documents / Resources

Radxa ZERO 3W Product Brief A Light, Compact and Tiny SBC Revision 1.0	**radxa ZERO 3W A Light Compact and Tiny SBC** [pdf] Owner's Manual ZERO 3W A Light Compact and Tiny SBC, 3W A Light Compact and Tiny SBC, Light Compact and Tiny SBC, Compact and Tiny SBC, Tiny SBC, SBC

References

- ✖ **Radxa Community**
- ✖ **Rock3/CM - Radxa Wiki**
- **User Manual**