Manuals+ — User Manuals Simplified.

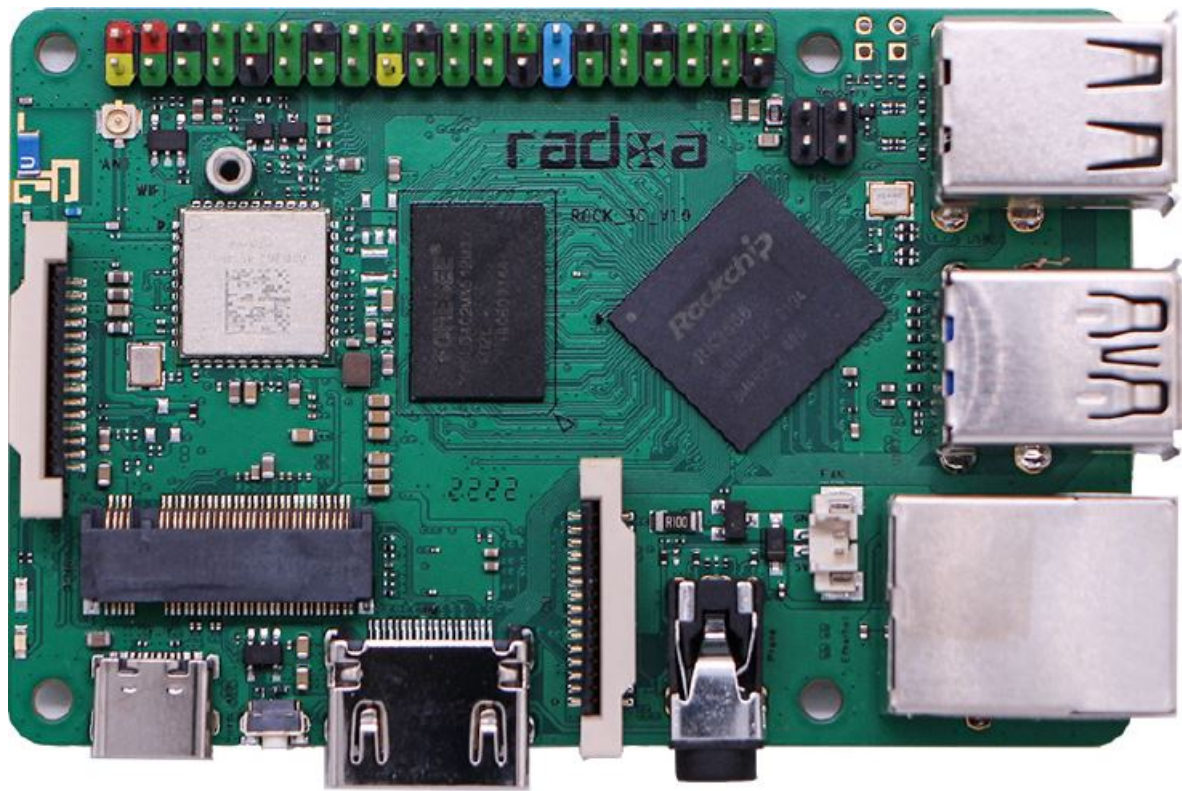# radxa ROCK 3C Single Board Computer User Manual

Contents

**radxa ROCK 3C Single Board Computer**

Revision

- Version Date Changes from the previous version
- 1.0 18/05/2023 First version

Introduction

Radxa ROCK 3C is a Single Board Computer (SBC) in an ultra-small form factor that offers class-leading performance while leveraging outstanding mechanical compatibility. Radxa ROCK 3C offers makers, IoT enthusiasts, hobbyists, PC DIY enthusiasts and others a reliable and extremely capable platform for building and tinkering their ideas into reality.
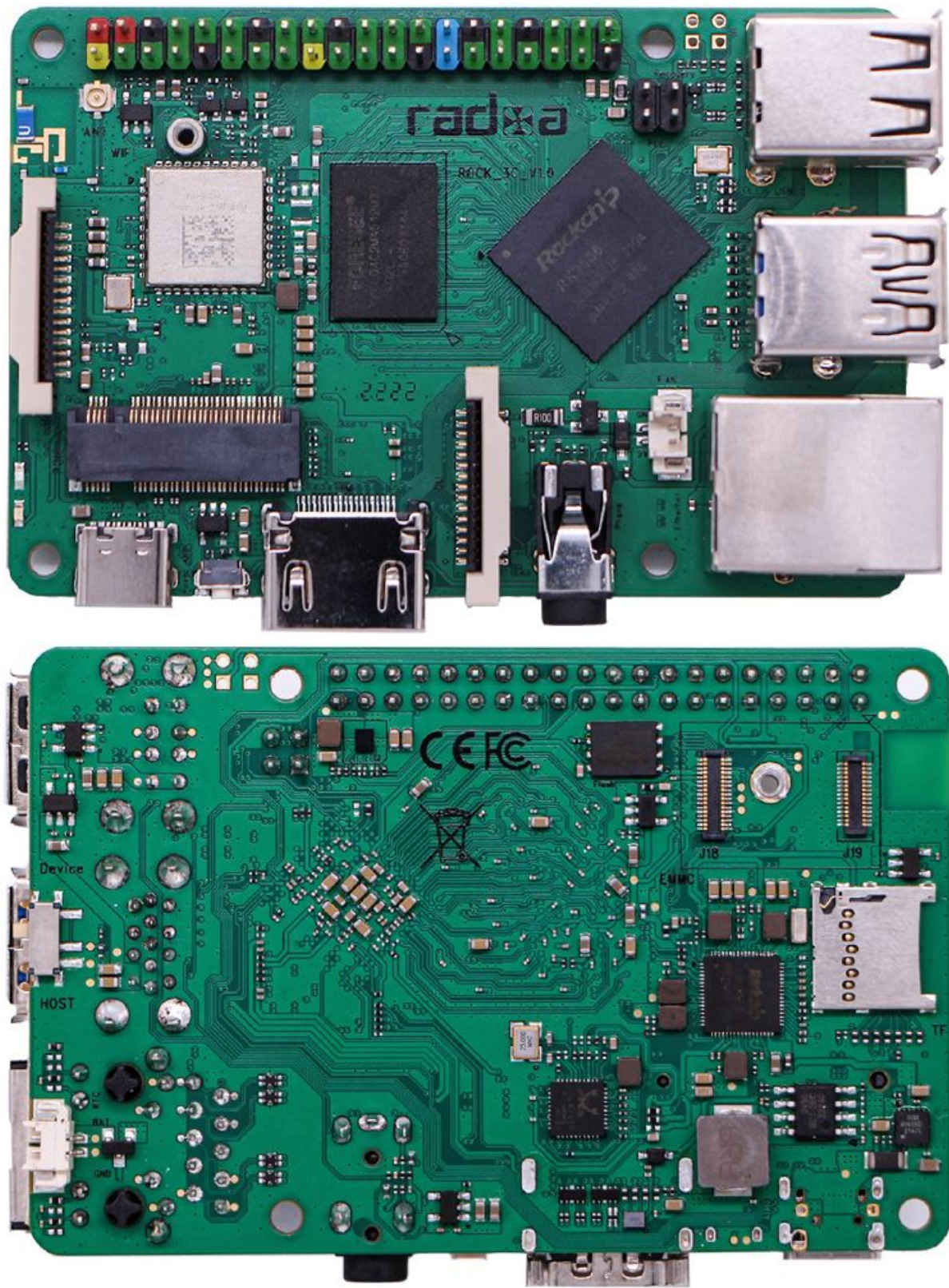
Features

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 LPDDR4 available
- Storage is supported by eMMC storage, micro SD card, and SSD through the M.2 connector

- Display via HDMI or MIPI DSI. They can not work at the same time
- H.264/H.265 decoder up to 4K@60fps
- H.264/H.265 encoder up to 1080P@60fps

Interfaces

- 802.11 b/g/n/ac Wireless LAN supporting WiFi 5
- BT 5.0
- 1x HDMI 2.0 port supporting displays up to 1080P@60fps resolution
- 1x SD Card slot
- 2x USB2 HOST ports
- 1x USB2 OTG/HOST port
- 1x USB3 HOST port
- 1x Gigabit Ethernet port. It supports PoE with add-on PoE HAT
- 1x M.2 M-Key connector for NVMe SSD or SATA SSD
- 1x camera port supporting 2-lane MIPI CSI
- 1x display port supporting 2-lane MIPI DSI
- 3.5mm jack with a microphone. The HD codec supports up to 24-bit/96KHz audio
- 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
- Android 11 support
- Hardware access/control library for Linux/Android

Electrical Specification

Power Requirements

- Radxa ROCK 3C can only be powered by +5V.
  - USB Type-C® 5V
  - 5V Power from the GPIO PIN 2 & 4
- The recommended power source capacity is at least 5V/3A without M.2 SSD or 5V/4A using with M.2 SSD.

GPIO Voltage

- GPIO Voltage Level Tolerance
- All GPIO 3.3V 3.63V

Peripherals

GPIO Interface
Radxa ROCK 3C offers 40P GPIO expansion which is compatible with most 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

eMMC Module Connector
ROCK 3C offers a high-speed eMMC socket for eMMC modules which can be used for OS and data storage. The eMMC socket is compatible with readily available industrial pinout and form factor hardware. The maximum eMMC size supported is 128GB.

Camera and Display Interfaces
Radxa ROCK 3C has 1x 2-lane MIPI CSI camera connector and a 1x 2-lane MIPI DSI display connector. These connectors are backward compatible with standard industrial cameras and display peripherals.

USB
Radxa ROCK 3C has two USB2 HOST connectors, one USB3 HOST connector, and one USB2 OTG/HOST connector. The board has a hardware switch to set the USB2 operation to either HOST or OTG. The power output across these ports is 2.8A in aggregate over the four connectors.

HDMI
Radxa ROCK 3C has one HDMI port supporting CEC and HDMI 2.0 with resolutions up to 1080P@60fps.

Audio Jack
The ROCK 3C supports near-CD-quality analog audio output via a 4-ring 3.5mm headphone jack. The HD codec supports up to 24 bits at 96Hz. The analog audio output can drive 32 Ohm headphones directly. The headphone

jack also supports a mic line input.

M.2 Connector
Radxa ROCK 3C offers an M.2 M-Key 2230 connector with PCIe 2.1 1-lane and SATA 3.0 combo interfaces, providing high-speed storage access. The M.2 M-Key can be configured either to support NVMe SSD or SATA devices, an additional adapter board is required for SATA support.

Operating Conditions

- The ROCK 3C has been designed to operate between 0°C to 50°C.
- The ROCK 3C is built on a high-performance mobile chipset that is designed to operate for extended durations on batteries with efficiency at its core. As with all electronic devices heat is a by-product of operation which increases performance and workload; during basic use cases such as web browsing, editing text, or listening to music the SoC will automatically select the dedicated hardware accelerators to reduce heat generation.
- Radxa ROCK 3C limits its SoC maximum internal temperature to 85°C before throttling the clock speeds to maintain reliability within the allowed temperature range. If the ROCK 3C is intended to be used continuously in high-performance applications, it may be necessary to use external cooling methods (for example, heat sink, fan, etc.) which will allow the SoC to continue running at maximum clock speed indefinitely below its predefined 85°C peak temperature limiter.

Fan Connector

Radxa ROCK 3C has a 2pin 1.25mm header that enables users to connect to a 5V fan (or other peripheral). The fan can be PWM controlled without speed feedback.

Availability
Radxa guarantees the availability of the ROCK 3C until at least September 2032.

Support
For support, please see the hardware documentation section of the Radxa Wiki website and post questions to the Radxa forum.

FCC STATEMENT

FCC WARNING
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 the receiver.
- Connect the equipment to 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 a minimum distance of 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 labeled in a visible area with the following: "Contains Transmitter Module 2A3PA-RADXA-ROCK3C".

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).FCC Part 15.407.

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 a 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.
Explanation: The EUT only has one Chip antenna, Yes, the module contains a permanently attached antenna, The 2.4G antenna gain is 1.5dBi. 5G antenna gain is 2.3dBi The use condition of the prototype is mobile.

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. 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 the limited module manufacturer reviewing 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 with 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.

- 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);
- 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);
- The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- Appropriate parts by manufacturer and specifications;
- Test procedures for design verification; and
- 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, requires 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 has no tracking antenna design, is a Chip antenna.

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,

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 "omnidirectional 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 a unique antenna connector must be used on Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT only has one Chip antenna, Yes, the module contains a permanently attached antenna, The 2.4G antenna gain is 1.5dBi. 5G antenna gain is 2.3dBi.

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 a label in a visible area indicating the following texts: "Contains FCC ID: 2A3PA-RADXA-ROCK3C.

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 simulate 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.
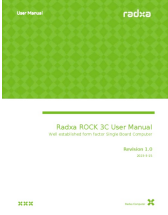
Explanation: WiFiRanger, A LinOra Company can increase the utility of our modular transmitters by providing instructions that simulate or characterizes a connection by enabling a transmitter.

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 with 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 host should be evaluated by the FCC Subpart B. This product uses a Chip antenna with a maximum The 2.4G antenna gain is 1.5dBi. 5G antenna gain is 2.3dBi.

Documents / Resources

[radxa ROCK 3C Single Board Computer](#) [pdf] User Manual
RK3566, 2A3PA-RADXA-ROCK3C, 2A3PARADXAROCK3C, ROCK 3C, ROCK 3C Single Board Computer, Single Board Computer, Board Computer, Computer

References

- ✖ **Radxa Forum**
- ✖ **Rock3 - Radxa Wiki**