

CKS3-1-W Datasheet



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Version Description

DATE	Description of changes	Author.
2025/2/6	V1.0 released	chen

About this manual

This manual describes the CKS3-1-W product parameters and contains the following sections

Chapter	caption	content
Chapter 1	Product Introduction	Overview of module features and functional applications
Chapter 2	Function Description	Description of module functions and specific explanations
Chapter 3	Electrical Characteristics	Introduction to basic electrical performance parameters of the module
Chapter 4	Module Types and Pin Definitions	Provision of module types, pin definitions, and functional descriptions
Chapter 5	PCB Design	Guidelines for module layout and PCB layout considerations
Chapter 6	Package Information	Provision of module package dimension drawings
Chapter 7	Certification description	Certification description
Chapter 8	Shipping Information	Explanation of module shipping methods

1. Product introduction

CKS3-1-W is a general-purpose Wi-Fi + low-power Bluetooth MCU module equipped with the ESP32-S3 series chip. In addition to a rich set of peripheral interfaces, the module boasts powerful neural network computing and signal processing capabilities, making it suitable for various application scenarios in the AIoT field, such as wake-word detection and voice command recognition, face detection and recognition, smart homes, smart appliances, smart control panels, smart speakers, and more.

CKS3-1-W integrates a variety of peripherals, including module interfaces: SPI, LCD, Camera interface, UART, I2C, I2S, infrared remote control, pulse counter, LED PWM, USB Serial/JTAG controller, MCPWM, SDIO host, GDMA, TWAI® controller (compatible with ISO11898-1), ADC, touch sensor, temperature sensor, timers, and watchdog, along with up to 45 GPIOs. Furthermore, the ESP32-S3 features a full-speed USB 1.1 On-The-Go (OTG) interface for USB communication.

The CKS3-1-W module utilizes an on-board PCB antenna and is configured with up to 16 MB of external SPI flash.

CKS3-1-W is available in eight variants, with different models featuring varying flash configurations, chip signals, and PSRAM sizes. A comparison of the different models is provided in the following table:

Ordering Code	flash(MB)	PSRAM(MB)	CHIP
CKS3-1-W-N4	4	0	ESP32-S3
CKS3-1-W-N8	8	0	ESP32-S3
CKS3-1-W-N16	16	0	ESP32-S3
CKS3-1-W-N4R2	4	2	ESP32-S3R2
CKS3-1-W-N4R8	4	8	ESP32-S3R8
CKS3-1-W-N8R2	8	2	ESP32-S3R2
CKS3-1-W-N8R8	8	8	ESP32-S3R8
CKS3-1-W-N16R2	16	2	ESP32-S3R2
CKS3-1-W-N16R8	16	8	ESP32-S3R8

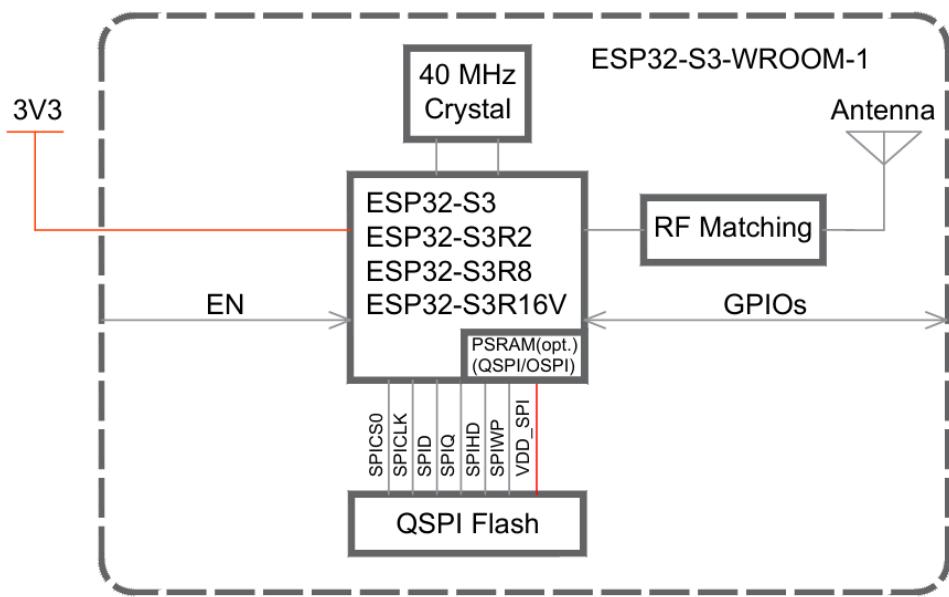
Note: The recommended operating ambient temperature range for the module is -40°C to 85°C.

Product Features

- Supports IEEE 802.11 b/g/n protocols, with support for 20MHz and 40MHz bandwidth in the 2.4GHz frequency band.
- Supports Bluetooth Low Energy (Bluetooth LE), Bluetooth 5, and Bluetooth mesh.
- Xtensa® 32-bit LX7 dual-core processor • Clock frequency: up to 240MHz.

2. Functional description

2.1 module functional block diagram



3. Electrical Characteristics

3.1 Rated Parameters

Conditions: VDD=3.3V±10%, GND=0V; tested at 25°C room temperature.

Parameter	instructions
modules name	CKS3-1-W
hardware interface	PWM,IIC,GPIO,UART
operating voltage	3.0V~3.6V
operating temperature	-20°C~85°C
Storage environment	Temperature: -10°C~75°C, relative humidity: 20%RH~80%RH
Wireless	wifi :IEEE802.11b/g/n/ax Bluetooth :Bluetooth5.0、Bluetoothmesh
Wireless Security Protocol	GCMP, CCMP, TKIP, WAPI, WEP, BIP, WPA2-PSK/WPA2-Enterprise, and WPA3-PSK/WPA3-Enterprise
Security	AES-128/256 (FIPS PUB 197),ECC,HMAC, RSA,SHA(FIPS PUB 180-4),Digital signature

Descriptions	Performance Parameters
wireless standard	IEEE 802.11 b/g/n/ax
Center frequency of operating channel	2412 ~ 2462 MHz

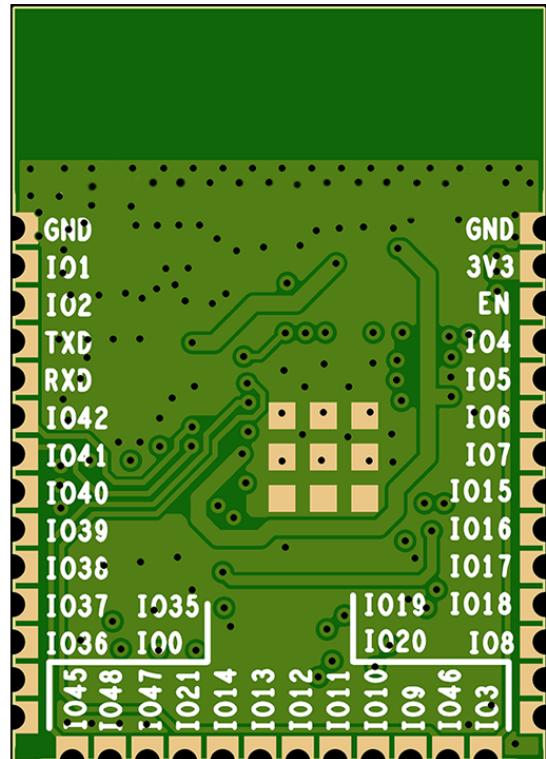
3.5 Bluetooth RF Specifications

Conditions: VDD=3.3V±10%, GND=0V; tested at 25°C room temperature.

Descriptions	Performance Parameters
wireless standard	Bluetooth5、Bluetoothmesh
Center frequency of operating channel	2402 ~ 2480 MHz

4. Pin Definitions

4.1 Pin Layout



CKS3-1-W Module Schematic

4.2 Pin Description

Name	No.	Type	Function
GND	1	P	GND
3V3	2	P	Powersupply
EN	3	I	High:on,enables the chip. Low:off,the chip powers off. Note:Do not leave the EN pin floating.
IO4	4	I/O/T	RTC_GPIO4,GPIO4,TOUCH4,ADC1_CH3
IO5	5	I/O/T	RTC_GPIO5,GPIO5,TOUCH5,ADC1_CH4
IO6	6	I/O/T	RTC_GPIO6,GPIO6,TOUCH6,ADC1_CH5
IO7	7	I/O/T	RTC_GPIO7,GPIO7,TOUCH7,ADC1_CH6
IO15	8	I/O/T	RTC_GPIO15,GPIO15,U0RTS,ADC2_CH4,XTAL_32K_P
IO16	9	I/O/T	RTC_GPIO16,GPIO16,U0CTS,ADC2_CH5,XTAL_32K_N
IO17	10	I/O/T	RTC_GPIO17,GPIO17,U1TXD,ADC2_CH6
IO18	11	I/O/T	RTC_GPIO18,GPIO18,U1RXD,ADC2_CH7,CLK_OUT3
IO8	12	I/O/T	RTC_GPIO8,GPIO8,TOUCH8,ADC1_CH7,SUBSPICS1
IO19	13	I/O/T	RTC_GPIO19,GPIO19,U1RTS,ADC2_CH8,CLK_OUT2,USB_D-
IO20	14	I/O/T	RTC_GPIO20,GPIO20,U1CTS,ADC2_CH9,CLK_OUT1,USB_D+
IO3	15	I/O/T	RTC_GPIO3,GPIO3,TOUCH3,ADC1_CH2
IO46	16	I/O/T	GPIO46
IO9	17	I/O/T	RTC_GPIO9,GPIO9,TOUCH9,ADC1_CH8,FSPIHD,SUBSPIHD
IO10	18	I/O/T	RTC_GPIO10,GPIO10,TOUCH10,ADC1_CH9,FSPICS0,FSPIIO4,SUBSPICS0
IO11	19	I/O/T	RTC_GPIO11,GPIO11,TOUCH11,ADC2_CH0,FSPID,FSPIIO5, SUBSPIID
IO12	20	I/O/T	RTC_GPIO12,GPIO12,TOUCH12,ADC2_CH1,FSPICLK,FSPIIO6,SUBSPICLK
IO13	21	I/O/T	RTC_GPIO13,GPIO13,TOUCH13,ADC2_CH2,FSPIQ,FSPIIO7, SUBSPIQ
IO14	22	I/O/T	RTC_GPIO14,GPIO14,TOUCH14,ADC2_CH3,FSPIWP,FSPIDQS, SUBSPIWP
IO21	23	I/O/T	RTC_GPIO21,GPIO21
IO47	24	I/O/T	SPICLK_P_DIFF,GPIO47,SUBSPICLK_P_DIFF
IO48	25	I/O/T	SPICLK_N_DIFF,GPIO48,SUBSPICLK_N_DIFF
IO45	26	I/O/T	GPIO45
IO0	27	I/O/T	RTC_GPIO0,GPIO0
IO35	28	I/O/T	SPIIO6,GPIO35,FSPID,SUBSPID
IO36	29	I/O/T	SPIIO7,GPIO36,FSPICLK,SUBSPICLK
IO37	30	I/O/T	SPIDQS,GPIO37,FSPIQ,SUBSPIQ
IO38	31	I/O/T	GPIO38,FSPIWP,SUBSPIWP

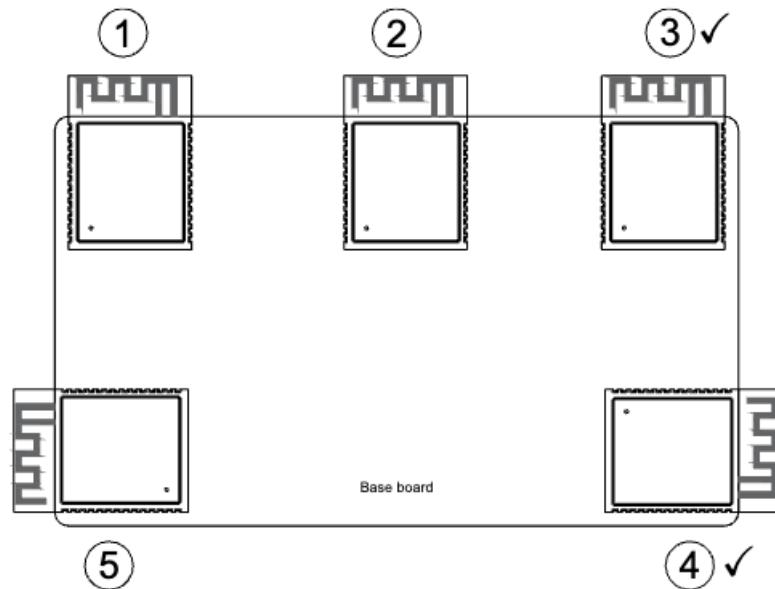
Name	No.	Type	Function
IO39	32	I/O/T	MTCK,GPIO39,CLK_OUT3,SUBSPICS1
IO40	33	I/O/T	MTDO,GPIO40,CLK_OUT2
IO41	34	I/O/T	MTDI,GPIO41,CLK_OUT1
IO42	35	I/O/T	MTMS, GPIO42
RXD0	36	I/O/T	U0RXD,GPIO44,CLK_OUT2
TXD0	37	I/O/T	U0TXD, GPIO43, CLK_OUT1
IO2	38	I/O/T	RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1
IO1	39	I/O/T	RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0
GND	40	P	GND

- P: power supply; I: input; O: output; T: high impedance. Pin functions in bold font are the default pin functions. For pin 28 ~ 30, the default function is decided by eFuse bit.
- For modules with Octal SPI PSRAM, i.e., modules embedded with ESP32-S3R8 or ESP32-S3R16V, pins IO35, IO36, and IO37 are connected to the Octal SPI PSRAM and are not available for other uses.
- For modules embedded with ESP32-S3R16V, as the VDD_SPI voltage of the ESP32-S3R16V chip is set to 1.8 V, the working voltage for GPIO47 and GPIO48 is also 1.8 V, which is different from other GPIOs.

5. PCB Layout Recommendations

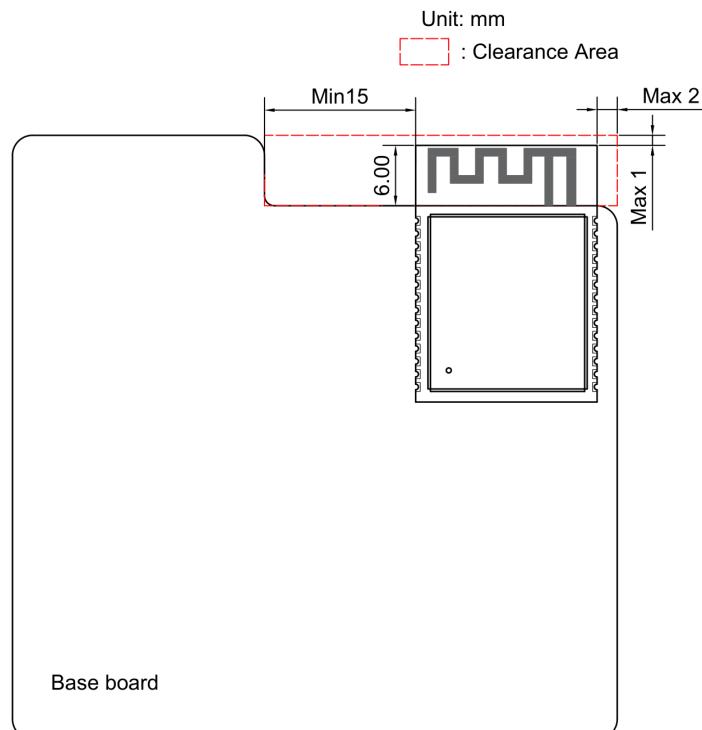
PCB layout and module layout considerations:

1. Pay attention to the module placement in PCB layout, as far as possible away from interference sources: magnetic components (such as motors, inductors, transformers, etc.), high-frequency signal devices (such as crystal, high-frequency clock signals, etc.)
2. Module PCB antenna area and expand 15 mm area to be empty (strictly prohibit the laying of copper, wire, placed components), such as the use of modules for on-board (on-board) design, need to pay attention to the layout of the module in the base plate, should minimise the impact of the base plate on the module PCB antenna performance. It is recommended to extend the antenna area of the module to the edge of the board, and place the feedpoints close to the edge of the bottom board. In the module placement diagram below, ✓ represents the highly recommended placement, other positions are not recommended.



CKS3-1-W Schematic of the position of the series module (antenna feed point on the right) on the base plate

If the antenna can not extend the edge of the board, please ensure that the PCB antenna to a large enough clearance area (prohibited laying copper, wire, placement of components), the clearance area is recommended to at least 15 mm. PCB antenna below the area of the bottom plate, please cut off, in order to minimise the impact of the bottom plate plate on the PCB antenna. The feed point is still placed as close as possible to the edge of the board. As an example, a module with the feedpoint on the right side is drawn with the recommended headroom area.

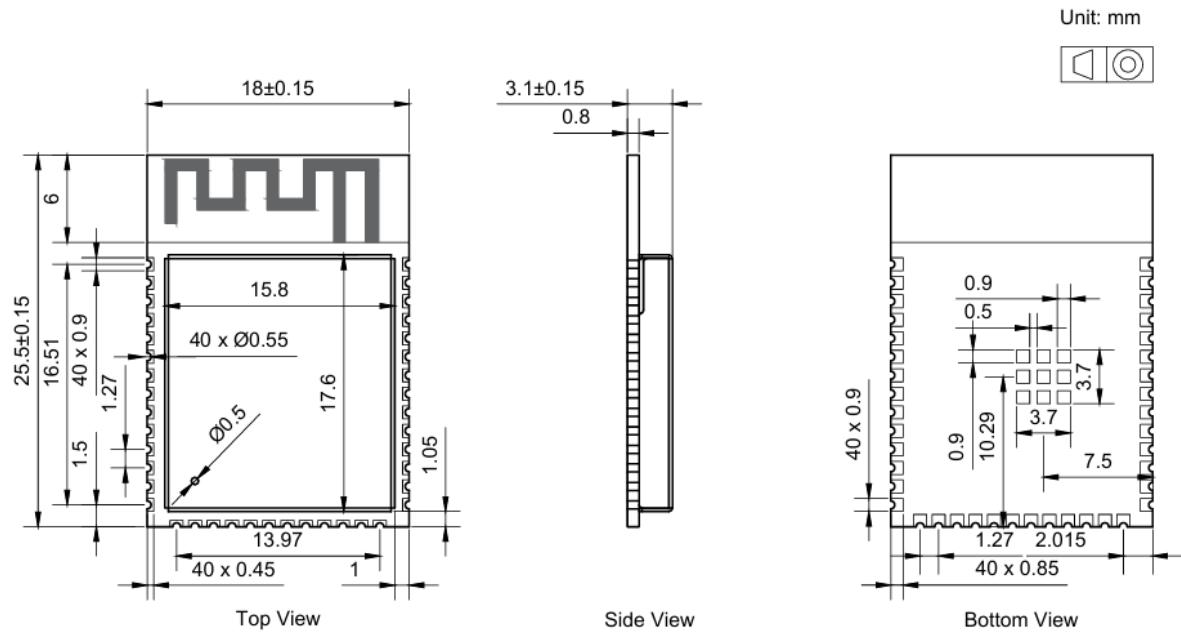


Schematic of antenna area clearance

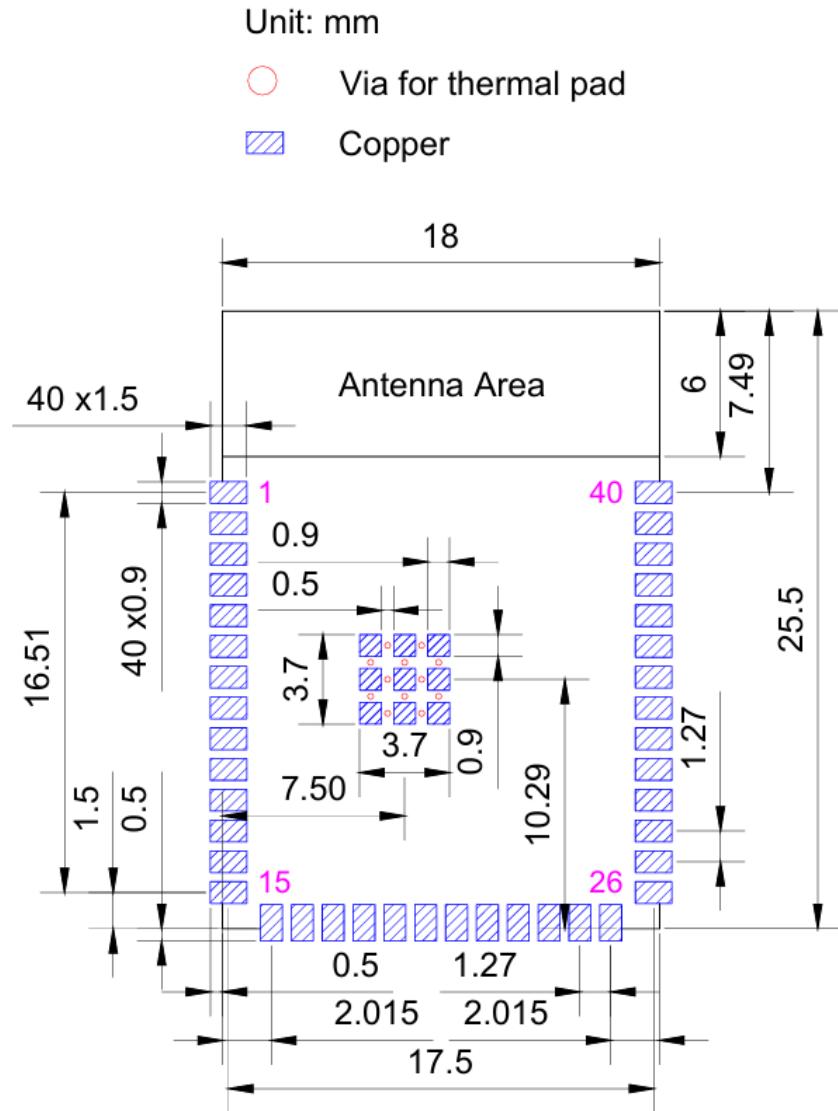
3. The module's power (VCC) pin capacitors and the module's other pin capacitors and resistors should be placed as close as possible to the module's pins, and the alignment path should be short.

6. Physical Dimensions

Module Dimensions:



Recommended PCB Land Pattern:



7. Certification description

7.1 FCC compliance 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 important announcement Important

Radiation Exposure Statement

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

2.7 Antennas

This radio transmitter FCC ID: 2A2SV-CKS31W has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Type of antenna:	Maximum Gain	Frequency range:
Bluetooth/2.4G Wi-Fi	PCB Antenna	0.85dBi	2400-2500MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following " Contains FCC ID: 2A2SV-CKS31W ".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacturer is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacturer only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.

8. Shipping Information

The CKS3-1-W module is shipped in a braided tape and reel package.



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