


Test report No:
2230387R-RF-US-P20V01

SAR Exemption Evaluation Report

Product Name	Wi-Fi & Bluetooth Internet of Things Module
TradeMark	ESPRESSIF
Model and /or type reference	ESP32-MINI-1
Contain FCC ID	2AC7Z-ESP32MINI1
Applicant's name / address	Espressif System (Shanghai) Co.,Ltd. Suite 204, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China.
Test method requested, standard	FCC Part1.1307 KDB 447498 D04V01
Verdict Summary	IN COMPLIANCE
Documented By (name / position & signature)	Tim Cao/ Project Engineer 
Approved by (name / position & signature)	Jack Zhang/ Supervisor 
Date of issue	2022-06-21
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COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date(receive sample)	Mar. 10, 2022
Date (start test)	Mar. 14, 2022
Date (finish test)	Mar. 18, 2022

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15°C - 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	: Equipment Under Test
QP	: Quasi-Peak
CAV	: CISPR Average
AV	: Average
CDN	: Coupling Decoupling Network
SAC	: Semi-Anechoic Chamber
OATS	: Open Area Test Site
BW	: Bandwidth
AM	: Amplitude Modulation
PM	: Pulse Modulation
HCP	: Horizontal Coupling Plane
VCP	: Vertical Coupling Plane
UN	: Nominal voltage
Tx	: Transmitter
Rx	: Receiver
N/A	: Not Applicable
N/M	: Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
2230387R-RF-US-P20V01	V1.0	Initial issue of report.	2022-05-06
2230387R-RF-US-P20V01	V1.1	Page 8: Update Pth value. (The test report No.: 2230387R-RF-US-P20V01 V1.1 is to replace the test report No.: 2230387R-RF-US-P20V01 V1.0, and test report 2230387R-RF-US-P20V01 V1.0 is obsoleted.)	2022-06-21

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with KDB 447498 and FCC Part 1.1307
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, it is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:
 - Chapter 1.3 Antenna information.

1. RF Exposure Evaluation

1.1. Limits

According to § 1.1307(b)(3)(i)(B)

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption threshold.

1.2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

The temperature and related humidity: 18°C and 78% RH.

1.3. Test Result of RF Exposure Evaluation

Product	:	ESP32-MINI-1
Test Item	:	RF Exposure Evaluation
Test Site	:	AC-6

Antenna information

Antenna model / type number	N/A			
Antenna serial number	N/A			
Antenna Delivery	<input checked="" type="checkbox"/>	1TX + 1RX		
	<input type="checkbox"/>	2TX + 2RX		
	<input type="checkbox"/>	Others:		
Antenna technology	<input checked="" type="checkbox"/>	SISO		
	<input type="checkbox"/>	MIMO	<input type="checkbox"/>	Basic
			<input type="checkbox"/>	CDD
			<input type="checkbox"/>	Sectorized
			<input type="checkbox"/>	Beam-forming
Antenna Type	<input type="checkbox"/>	External	<input type="checkbox"/>	Dipole
			<input type="checkbox"/>	Sectorized
	<input checked="" type="checkbox"/>	Internal	<input type="checkbox"/>	PIFA
			<input checked="" type="checkbox"/>	PCB
			<input type="checkbox"/>	Metal Antenna
Antenna Gain	2.7 dBi			

Note: The antenna information for the EUT in clause 1.3 are provided and confirmed by the client.

The tune-up power is 0.5 dB, so the maximum conducted power we used to calculate RF exposure is 7.77 dBm.

Band	Exposure Condition	Pmax	EIRP	ERP	Distance	f(GHz)	Pth (mW)	SAR Test
		(dBm)	(mw)	(mw)	(mm)			
Wi-Fi	Lamb	7.77	11.15	6.80	13	2.462	42.1	Not required

Conclusion: 2.4GHz SAR was not required.

_____ The End _____