TEST REPORT

Report Number: C21T00111-EMC01-V00

Applicant	ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD
Product Name	Wi-Fi & Bluetooth Internet of Things Module
Model Name	ESP32-WROOM-DA
Brand Name	ESPRESSIF
FCC ID	2AC7Z- ESPWROOMDA

Industrial Internet Innovation Center (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in FCC Part 15, Subpart B, ANSI C63.4-2014.

Prepared by		Reviewed by	
Approved by		Issue Date	2021-12-03

Industrial Internet Innovation Center (Shanghai) Co., Ltd.

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10. The measurement uncertainty is not taken into account when deciding conformity, and the results of measurement (or the average of measurement results) are directly used as the criterion for the stating conformity.

Test Laboratory:
Industrial Internet Innovation Center (Shanghai) Co., Ltd.
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Revision Version

Report Number	Revision	Date	Memo
C21T00111-EMC01-V00	00	2021-12-03	Initial creation of test report

CONTENTS

1. Test Laboratory

1.1. Testing Location

Primary Lab:

Company Name	Industrial Internet Innovation Center (Shanghai) Co., Ltd.
Address	Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China
FCC Registration No.	958356
FCC Designation No.	CN1177

Subcontracting Lab #1:

Company Name	N/A
Address	N/A

1.2. Testing Environment

Normal Temperature	15℃~35℃
Relative Humidity	30%RH~60%RH
Supply Voltage	DC 5V

1.3. Project Information

Project Leader	Wang Wenwen
Testing Start Date	2021-09-25
Testing End Date	2021-09-30

2. Client Information

2.1. Applicant Information

Company Name	ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD
Address	Suite 101, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China
Telephone	15921838395

2.2. Manufacturer Information

Company Name	ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD
Address	Suite 101, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China
Telephone	15921838395

3. Equipment under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Product Name	Wi-Fi & Bluetooth Internet of Things Module
Model name	ESP32-WROOM-DA
Supported Radio Technology and Bands	802.11b,g,n BT 4.2
Hardware Version	V1.1
Software Version	V1.1.3.0

Note: Photographs of EUT are shown in ANNEX B of this test report.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of Receipt
N01	N/A	V1.1	V1.1.3.0	2021/09/15

*EUT ID: is internally used to identify the test sample in the lab.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	SN/Remark
EA01	PCB	N/A	N/A
AE1	Notebook PC	DELL Latitude E6510	N/A
AE2	USB Cable	N/A	N/A
AE3	Test Software	EspRFTestTool	N/A

*AE ID: is internally used to identify the test sample in the lab.

*The AE1~2 is provided by the lab, the AE 3 is provided by the client.

4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 15, Subpart B	Radio frequency devices	2020/10/1
ANSI C63.4	Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2014

5. Test Summary

5.1. Summary of Test Results

Items	Test List	Standard	Verdict
1	Radiated Emission (DC power ports)	15.107(a)	Pass

5.2. Statements

The ESP32-WROOM-DA, manufactured by ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 5.1.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

Note: This DUT has two antennas, one of antenna's gain is 0.91 dBi, another is 1.06 dBi, and the report results are tested by using the maximum gain antenna, which is the worst-case model showed in the the report.

5.3. Decision of final test mode

The EUT was tested together with the above additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

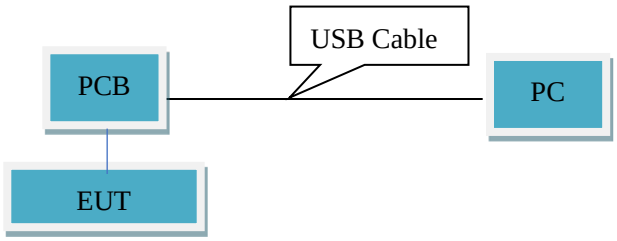
The test configuration modes are as the following:

Test Item	Test setup and operating modes
Radiated emission	30MHz-18GHz frequency range: Mode 1: 2.4GWLAN Link mode <Figure 1> Mode 2: BT Link mode <Figure 1> Mode 3: BLE Link mode <Figure 1>
Remark: 1. All test modes are performed, only the worst cases test data are recorded in this report. 2. The worst case of radiated emission for 30MHz-1GHz is mode 2 and for 1GHz -18GHz is mode 3.	

5.4. EUT System Operation

1. Connect the EUT with AE.
2. Setup the EUT according to the standard, connect the EUT with Universal Radio Communication.
3. Start testing and monitoring the function.
4. The EUT and PCB board are connected to PC through USB cable, powered by PC USB DC5V, and controlled by EspRFTestTool to transmit and receive BT/WLAN to keep it in working state.

5.5. EUT Connection Diagram of Test System



<Figure 1> Mode 1-3

6. Measurement Results

6.1. Radiated Emission

Method of Measurement

a. For 30MHz -1000MHz, the EUT was placed on the top of a rotating 0.8m table above the ground at a semi-anechoic chamber. The distance between the EUT and the received antenna was 3 meters. The table was rotated 360 degree and the received antenna mounted on a variable-height antenna tower was varied from 1m to 4m to find the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were set during the measurement.

b. For 1000MHz-18000MHz, the maximal emission value was acquired by adjusting the antenna height, the table was rotated 360 degree to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were set during the measurement.

Limits for Radiated Emission at a measuring distance of 3m

Table 1:

Frequency Range (MHz)	Quasi-Peak (dBμV/m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Table 2:

Frequency Range (MHz)	Peak (dBμV/m)	Average (dBμV/m)
Above 1000	74	54

Table 3:

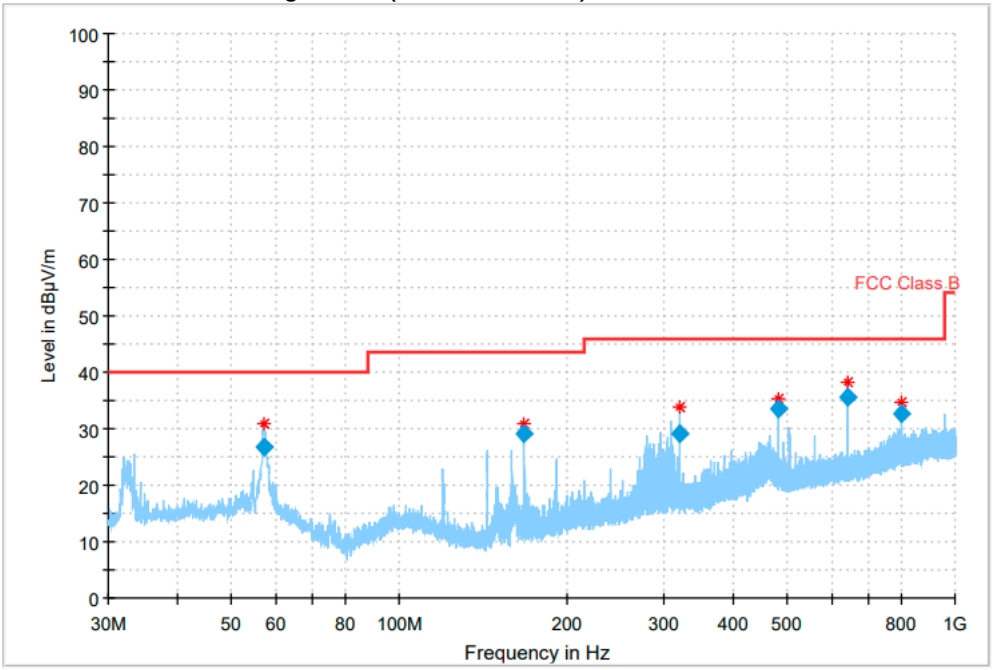
Test conditions

Frequency Range (MHz)	RBW/VBW	Sweep Time (s)
30-1000	120kHz/300kHz	Auto
1000-18000	1MHz/3MHz	Auto

Test Results

Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier, the Emissions in the frequency band 18GHz-40GHz is more than 20dB below the limit are not report.

Mode 1: 2.4GWLAN Link mode <Figure 1> (30MHz –1GHz)



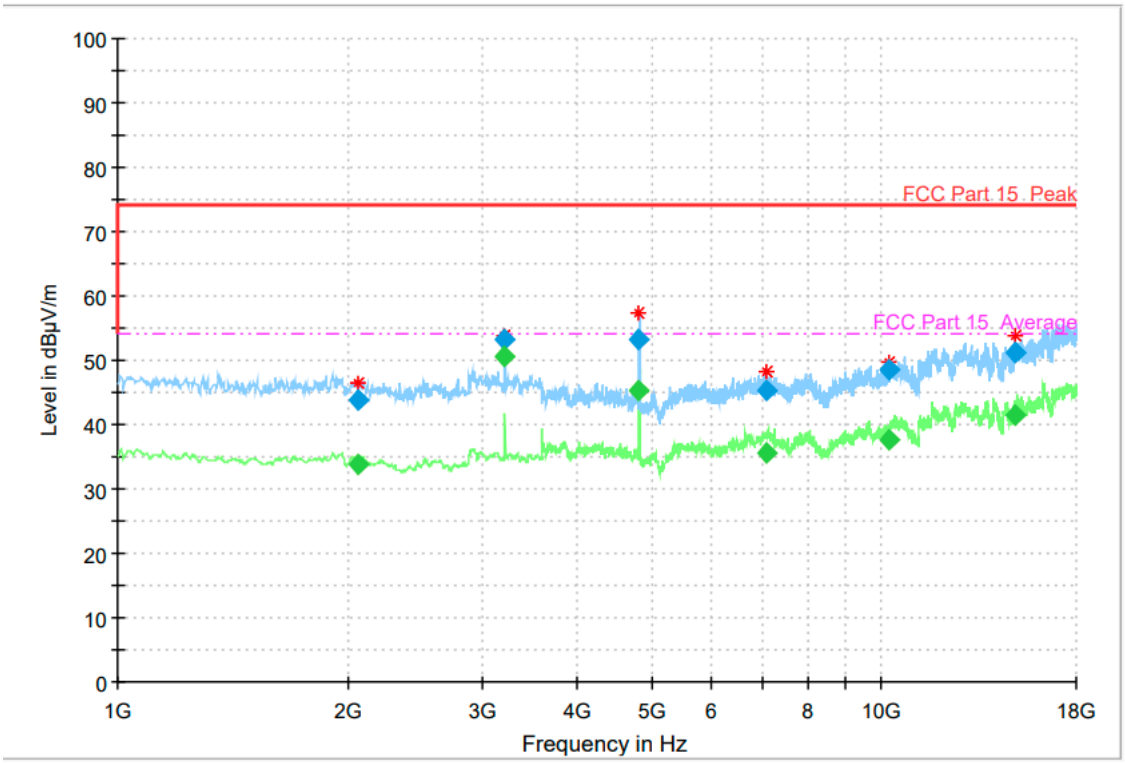
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
57.371709	26.78	40.00	13.22	1000.0	120.000	125.0	H	77.0	-12.2
168.060659	29.26	43.50	14.24	1000.0	120.000	179.0	H	-2.0	-15.8
319.997987	29.15	46.00	16.85	1000.0	120.000	100.0	H	182.0	-10.3
479.998941	33.64	46.00	12.36	1000.0	120.000	179.0	H	353.0	-7.1
639.991403	35.66	46.00	10.34	1000.0	120.000	100.0	V	121.0	-3.6
800.003685	32.72	46.00	13.28	1000.0	120.000	100.0	H	243.0	-2.0

Note:

1. Emission level(QP)=Raw value by receiver + Corr(Antenna factor + cable loss - preamplifier gain)
2. The raw value is used to calculate by software which is not shown in the sheet.
3. Margin=limit value – emission level.

Mode 1: 2.4GWLAN Link mode <Figure 1> (1GHz –18GHz)

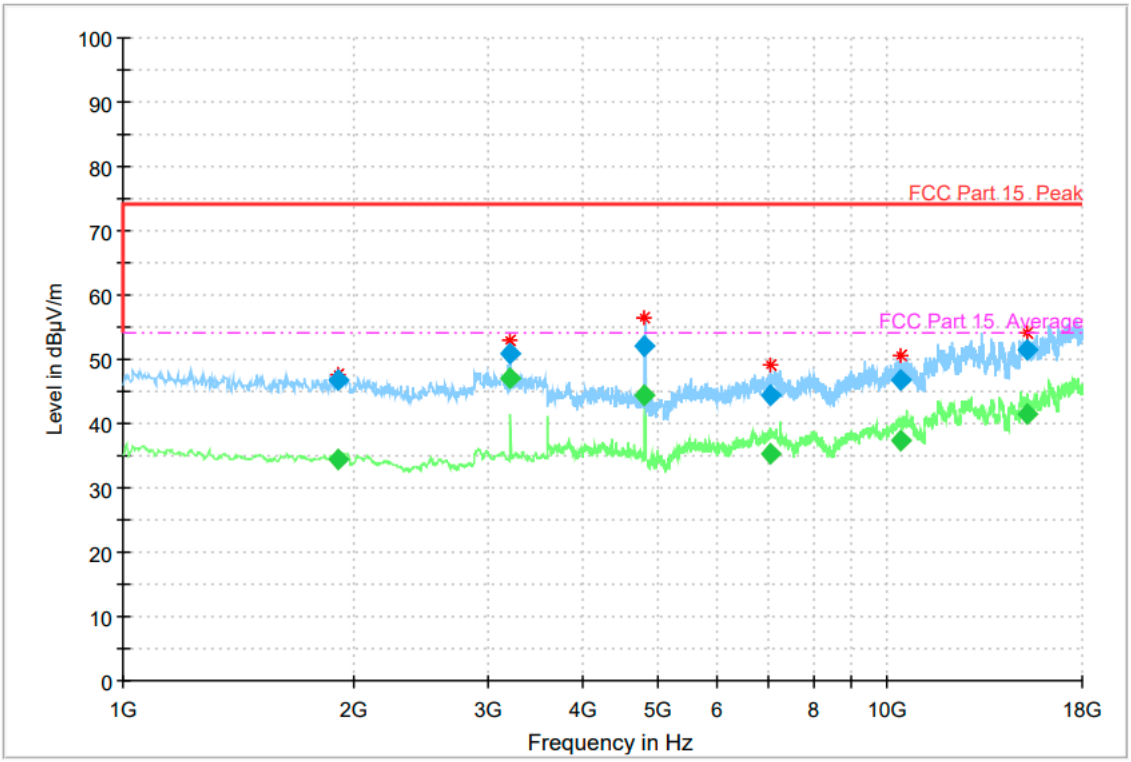


Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2071.20000	---	33.75	54.00	20.25	1.0	1000.	200.0	H	280.0	2071
2071.20000	43.70	---	74.00	30.30	1.0	1000.	200.0	H	280.0	2071
3216.00000	53.24	---	74.00	20.76	1.0	1000.	100.0	H	136.0	3216
3216.00000	---	50.51	54.00	3.49	1.0	1000.	100.0	H	136.0	3216
4820.60000	53.15	---	74.00	20.85	1.0	1000.	100.0	H	194.0	4820
4820.60000	---	45.19	54.00	8.81	1.0	1000.	100.0	H	194.0	4820
7096.00000	45.19	---	74.00	28.81	1.0	1000.	100.0	H	37.0	7096
7096.00000	---	35.66	54.00	18.34	1.0	1000.	100.0	H	37.0	7096
10258.0000	---	37.60	54.00	16.40	1.0	1000.	100.0	H	12.0	1025
10258.0000	48.51	---	74.00	25.49	1.0	1000.	100.0	H	12.0	1025
14937.2000	51.05	---	74.00	22.95	1.0	1000.	100.0	H	95.0	1493
14937.2000	---	41.53	54.00	12.47	1.0	1000.	100.0	H	95.0	1493

Note:

1. Emission level (peak or average)=Raw value by receiver + Corr (Antenna factor+ cable loss-preamplifier gain)
2. The raw value is used to calculate by software which is not shown in the sheet.
3. Margin=limit value – emission level.



Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1917.20000	---	34.50	54.00	19.50	1.0	1000.	100.0	V	0.0	1917
1917.20000	46.66	---	74.00	27.34	1.0	1000.	100.0	V	0.0	1917
3216.20000	50.92	---	74.00	23.08	1.0	1000.	200.0	V	149.0	3216
3216.20000	---	47.14	54.00	6.86	1.0	1000.	200.0	V	149.0	3216
4821.00000	51.95	---	74.00	22.05	1.0	1000.	100.0	V	19.0	4821
4821.00000	---	44.42	54.00	9.58	1.0	1000.	100.0	V	19.0	4821
7025.40000	44.54	---	74.00	29.46	1.0	1000.	100.0	V	202.0	7025
7025.40000	---	35.39	54.00	18.61	1.0	1000.	100.0	V	202.0	7025
10421.4000	---	37.47	54.00	16.53	1.0	1000.	100.0	V	330.0	1042
10421.4000	46.64	---	74.00	27.36	1.0	1000.	100.0	V	330.0	1042
15239.2000	51.50	---	74.00	22.50	1.0	1000.	100.0	V	176.0	1523
15239.2000	---	41.38	54.00	12.62	1.0	1000.	100.0	V	176.0	1523

Note:

1. Emission level (peak or average) = Raw value by receiver + Corr (Antenna factor+ cable loss-preamplifier gain)
2. The raw value is used to calculate by software which is not shown in the sheet.
3. Margin=limit value – emission level.

7. Test Equipment List

7.1. Radiated Emission Equipment list

Item	Equipment Name	Type	Serial Number	Manufacturer	Cal. Date	Cal. interval
1	Test Receiver	ESU40	100307	R&S	2021-03-03	1 year
2	Trilog Antenna	VULB9163	VULB9163-515	Schwarzbeck	2021-02-03	2 years
3	Double Ridged Guide Antenna	ETS-3117	00135890	ETS	2020-02-28	2 years
4	EMI Test Software	EMC32 V9.15	N/A	R&S	N/A	N/A

Annex A: Measurement Uncertain

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of *k*=2.

Case	Uncertainty
Radiated Emission 30MHz-1000MHz	4.96 dB
Radiated Emission 1000MHz-18000MHz	5.18 dB

Annex B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 12th day of April 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

**********END OF REPORT**********