

MPE TEST REPORT

Applicant	Shelly Europe Ltd.
FCC ID	2BDC6-SHELLYXMOD1H8
Product	2.4G Wi-Fi & Bluetooth Module
Brand	Shelly
Model	Shelly-X-MOD1-H8
Report No.	R2403A0309-M1V2
Issue Date	July 2, 2024

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC 47 CFR Part 1 1.1310**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Wei Fangying

Approved by: Fan Guangchang

Eurofins TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

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Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	April 11, 2024
Rev.1	Update information.	May 27, 2024
Rev.2	Update description.	July 2, 2024

Note: This revised report (Report No.: R2403A0309-M1V2) supersedes and replaces the previously issued report (Report No.: R2403A0309-M1V1). Please discard or destroy the previously issued report and dispose of it accordingly.

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

1.3 Testing Location

Company: Eurofins TA Technology (Shanghai) Co., Ltd.
Address: Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City: Shanghai
Post code: 201201
Country: P. R. China
Contact: Fan Guangchang
Telephone: +86-021-50791141/2/3
Fax: +86-021-50791141/2/3-8000
Website: <https://www.eurofins.com/electrical-and-electronics>
E-mail: Jack.Fan@cpt.eurofinscn.com

1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2 Description of Equipment under Test

Client Information

Applicant	Shelly Europe Ltd.
Applicant address	103 Cherni Vrah Blvd. 1407 Sofia, Bulgaria
Manufacturer	Espressif Systems (Shanghai) Co.,Ltd.
Manufacturer address	Suite 204, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China

General Technologies

Model	Shelly-X-MOD1-H8
Lab internal SN	(Original)R2103A0270/S01
Hardware Version	V1.4
Software Version	V1.1.3.0
Date of Testing:	(Original) April 4, 2021 ~ April 30, 2021
<p>Note: 1. The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.</p> <p>2. All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.</p>	

Shelly-X-MOD1-H8 (Report No.: R2403A0309-M1V2) is a variant model of ESP32-C3-MINI-1 (Report No.: R2103A0270-M1V1; FCC ID: 2AC7Z-ESPC3MINI1; Date of Grant: 06/16/2021). This report only changes Brand Name, Product Name, Model Name, Applicant and Applicant address.

There is no test for variant in this report. Test values all duplicated from original report (Report No.: R2103A0270-M1V1).

The detailed product change description please refers to the *Difference Declaration Letter*.

3 Maximum Tune Up and Antenna Gain

The numeric gain (G) of the antenna with a gain specified in dB is determined by

Numeric gain (G)=10^(antenna gain/10)

Band		Maximum Tune Up Power		Antenna Gain (dBi)	Numeric gain
		(dBm)	(mW)		
2.4G	802.11b	20	100.00	3.96	2.489
	802.11g	19	79.43	3.96	2.489
	802.11n HT20	19	79.43	3.96	2.489
	802.11n HT40	18.5	70.79	3.96	2.489
Bluetooth (Low Energy)		6	3.98	3.96	2.489

4 Test Result

According to section 1.1310 of FCC 47 CFR Part 1, limits for maximum permissible exposure (MPE) are as following

TABLE 1 – LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500 .....	.....	.....	f/300	6
1500-100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500 .....	.....	.....	f/1500	30
1500-100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note1. Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational / controlled limits apply provided he or she is made aware of the potential for exposure.

Note2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

The maximum permissible exposure for 1500~100,000MHz is 1.0. So

Band	The Maximum Permissible Exposure (mW/cm ²)
802.11b	1.000
802.11g	1.000
802.11n HT20	1.000
802.11n HT40	1.000
Bluetooth (Low Energy)	1.000

5 RF Exposure Evaluation Result

RF exposure evaluation method is based on KDB 447498 D01, this calculation is based on the conducted power, maximum power and antenna gain with provides the minimum separation distance. The formula shown below is from OET Bulletin 65 Edition 97-01 Per KDB 447498 D01:

$$S = PG / 4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = Time-average maximum tune up procedure (in appropriate units, e.g., mW)

G = the numeric gain of the antenna

R = distance to the center of radiation of the antenna (20 cm = limit for MPE)

Band	PG (mW)	Result (mW/cm ²)	Limit Value (mW/cm ²)	Conclusion
802.11b	248.886	0.050	1.000	Pass
802.11g	197.697	0.039	1.000	Pass
802.11n HT20	197.697	0.039	1.000	Pass
802.11n HT40	176.198	0.035	1.000	Pass
Bluetooth (Low Energy)	9.908	0.002	1.000	Pass
Note: R = 20cm $\pi = 3.1416$				

Bluetooth antenna and Wi-Fi 2.4G antenna can't transmit simultaneously.

Note: For transmitters, minimum separation distance is 20cm, even if calculations indicate MPE distance is less.

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Product Change Description

The Product Change Description are submitted separately.

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