

FCC Maximum Permissible Exposure (MPE) Estimation Report

Report Number : **68.950.24.1258.01A** Date of Issue: **2025-01-14**

Model/HVIN : **FS2345**

Product Type : AURIA module

Applicant : Frontier Smart Technologies Ltd

Address : Harston, Harston Mill, Cambridge, CB22 7GG, UNITED KINGDOM

Manufacturer : Frontier Smart Technologies Ltd

Address : Harston, Harston Mill, Cambridge, CB22 7GG, UNITED KINGDOM

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : **10**

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park,
Guankou Erlu, Nantou, Nanshan District,
Shenzhen, Guangdong, China

Telephone: 86 755 8828 6998

Fax: 86 755 8828 5299

FCC Registration No.: 514049

FCC Designation Number: CN5009

3 Description of the Equipment Under Test

Product:	AURIA module
Model no.:	FS2345
FCC ID:	YYX-FS2345
IC:	11458A-FS2345
PMN:	AURIA
HVIN:	FS2345
Rating:	5VDC
No. of Operated Channel:	79 for Bluetooth 40 for BLE 11 for 2.4GHz Wi-Fi 25 for 5GHz Wi-Fi
RF Transmission Frequency:	BLE or Bluetooth: 2402MHz-2480MHz 2.4GHz Wi-Fi: 2412MHz-2462MHz 5GHz Wi-Fi: 5.180GHz~5.240GHz; 5.260GHz~5.320GHz; 5.500GHz~5.720GHz; 5.745GHz~5.825GHz
Modulation:	Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK BLE: GFSK 2.4GHz Wi-Fi: 802.11b/g/n20 /ax20 5GHz Wi-Fi: 802.11a: BPSK, QPSK, 16QAM, 64QAM 802.11n: BPSK, QPSK, 16QAM, 64QAM 802.11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM 802.11ax: BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
Antenna Type:	Ant 1: Internal PIFA Antenna Ant 2: External PIFA Antenna
Antenna Gain:	Ant 1: 1.86 dBi Max for 2400-2483.5MHz 2.75 dBi Max for 5150-5250MHz 3.02 dBi Max for 5250-5350MHz 2.04 dBi Max for 5470-5725MHz 0.22 dBi Max for 5725-5850MHz Ant 2: 2.21 dBi Max for 2400-2483.5MHz 2.11 dBi Max for 5150-5250MHz 3.42 dBi Max for 5250-5350MHz

4.54 dBi Max for 5470-5725MHz
3.05 dBi Max for 5725-5850MHz
FS2345 does not support MIMO, only one of Ant 1 or Ant 2 can transmit through a switch selection

S/N

Conducted Method Module: 241500278RYA02
Conducted Method Platform: FS2345032403053
Radiated Method Module: 241500246RYA02
Radiated Method Platform: FS2345032403028
Normal Module: 240100004RYA02
Normal Platform: FS2345032403037

Description of the EUT:

The Equipment Under Test (EUT) is a AURIA module supports Bluetooth Low Energy / Bluetooth BR+EDR/ Wi-Fi functions

4 General Information

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Prepared By
Project Engineer

2025-01-14

Date

Henry Chen

Name



Signature

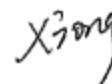
Approved By
Project Manager

2025-01-14

Date

Alan Xiong

Name



Signature

5 Test Specifications

Test Standards	
ANSI Std C95.1-2019	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
KDB 447498 D01	General RF Exposure Guidance v06
CFR § 2.1091	Radiofrequency radiation exposure evaluation: mobile devices.

6 RF Exposure Requirements

An estimation of MPE in this application for product is used to ensure if it complies with the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

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.

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 cannot exercise control over their exposure.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

EIRP = P * G

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

7 FCC MPE Limits

According to subpart 15.247(i) and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

We analysis if it complies with the limits for General population/uncontrolled exposure. The FCC MPE limits for field strength and power density are given in 47CFR 1.1310 (Table below) and KDB447498 D01 v06. These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

(B) Limits for General Population/uncontrolled Exposure				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm ²)	Averaging Time (minute) E ² , H ² or S
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	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	

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0

8 RF Exposure Evaluation (FCC)

8.1.1 Calculation of Power Density for Single Chain Transmitters

Mode	EIRP (dBm)	EIRP (mW)	R (cm)	S (mW/cm ²)	Limit (mW/cm ²)	MPE Ratio
Bluetooth	9.25	8.41	20	0.002	1.0	0.2%
BLE	7.75	5.96	20	0.001	1.0	0.1%
2.4GHz Wi-Fi	25.22	332.66	20	0.066	1.0	6.6%
5GHz Wi-Fi	17.1	51.29	20	0.010	1.0	1.0%

8.1.2 Calculation of Simultaneous Transmission

In order to ensure compliance with the EMF for a controlled environment, the sum of the ratios of the power density to the corresponding EMF should not exceed unity. That is

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

The product also has multiple transmitters. The worst-case simultaneous transmission possibilities are as below:

No.	Simultaneous Tx Combination	S (mW/cm ²)	MPE Ratio	Limit
1	Bluetooth+BLE+2.4GHz Wi-Fi+5GHz Wi-Fi	0.079	7.9%	1.0

8.1.3 Conclusion

According to the table above, we can conclude that the limit percentage of above supporting frequency bands calculation results are less than 1, therefore, the product meets the requirements.