

# Radio Exposure Evaluation Report

**FCC ID** : XPYMAW4A

**Equipment** : Host-based multi-radio modules with Wi-Fi 6, Bluetooth Low Energy 5.4 and 802.15.4

**Brand Name** : u-blox

**Model Name** : MAYA-W476-00B, MAYA-W466-00B, MAYA-W446-00B, MAYA-W436-00B, MAYA-W473-00B, MAYA-W463-00B, MAYA-W443-00B, MAYA-W433-00B

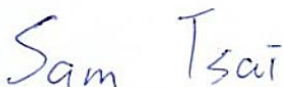
**Applicant** : u-Blox AG  
Zürcherstrasse 68, 8800 Thalwil Switzerland

**Manufacturer** : u-Blox AG  
Zürcherstrasse 68, 8800 Thalwil Switzerland

**Standard** : 47 CFR FCC Part 2 Subpart J, section 2.1091

The product was received on Nov. 28, 2024, and testing was started from Dec. 17, 2024 and completed on Dec. 27, 2024. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR FCC Part 2 Subpart J, section 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.



Approved by: Sam Tsai

**SPORTON INTERNATIONAL INC. Hsinhua Laboratory**  
No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)



## **Table of Contents**

<b>HISTORY OF THIS TEST REPORT .....</b>	<b>3</b>
<b>SUMMARY OF TEST RESULT .....</b>	<b>4</b>
<b>1 GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1 Information.....	5
1.2 Applicable Standards .....	8
1.3 Testing Location .....	8
<b>2 MAXIMUM PERMISSIBLE EXPOSURE .....</b>	<b>9</b>
2.1 Limit of Maximum Permissible Exposure .....	9
2.2 RF Exposure Exempt Measurement .....	10
2.3 Multiple RF Sources Exposure.....	11
2.4 MPE Calculation Method .....	12
2.5 Calculated Result and Limit.....	13
<b>Photographs of EUT V01</b>	



## History of this test report

Report No.	Version	Description	Issued Date
FA4O2915	01	Initial issue of report	Jan. 22, 2025



## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

None

**Reviewed by: Ben Tseng**

**Report Producer: Julie Tseng**

# 1 General Description

## 1.1 Information

### 1.1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850 5850-5895	5180-5240 5260-5320 5500-5720 5745-5825 5845-5885	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	LE: DSSS (GFSK)
ZigBee	2400-2483.5	2405-2480	DSSS (O-QPSK)

### 1.1.2 Antenna Information

#### MAYA-W476-00B

Ant.	Brand	Model Name	Antenna Type	Support
1	U-Blox	MAYA-W4 PCB	PCB Antenna	2.4G+5G+BLE+802.15.4

Ant.	Gain (dBi)							
	2.4G	UNII-1	UNII-2A	UNII-2C	UNII-3	UNII-4	BT	802.15.4
1	1.56	-1.74	1.56	1.56	-2.23	-0.95	1.56	1.56

#### For 2.4GHz function:

For IEEE 802.11 b/g/n/ax mode (1TX/1RX)

Ant. 1 could transmit/receive.

#### For 5GHz function:

For IEEE 802.11 a/n/ac/ax mode (1TX/1RX)

Ant. 1 could transmit/receive.

#### For BT function:

For IEEE 802.15.1 Bluetooth mode (1TX/1RX)

Ant. 1 could transmit/receive.

#### For Zigbee function:

For IEEE 802.15.4 mode (1TX/1RX)

Ant. 1 could transmit/receive.

**MAYA-W473-00B**

Ant.	Brand	Model Name	Antenna Type	Support
1	Linx	ANT-DB1-RAF-RPS	Dual-band dipole antenna	2.4G+5G+BLE+802.15.4
2	Chang Hong	DA-2458-02-SMR	Dual-band dipole antenna	2.4G+5G+BLE+802.15.4
3	Laird	001-0012	Dual-band dipole antenna	2.4G+5G+BLE+802.15.4
4	Taoglas	GW.59.3153	Dual-band dipole antenna	2.4G+5G+BLE+802.15.4
5	Laird	MAF94051	Dual-band dipole antenna	2.4G+5G+BLE+802.15.4
6	Unictron	H2B1PD1A1C385L	PCB antenna	2.4G+5G+BLE+802.15.4
7	Molex	1461530050	PCB antenna	2.4G+5G+BLE+802.15.4
8	Molex	2042810100	PCB antenna	2.4G+5G+BLE+802.15.4

Ant.	Gain (dBi)							
	2.4G	UNII-1	UNII-2A	UNII-2C	UNII-3	UNII-4	BT	802.15.4
1	4.1	5.1	5.1	5.1	5.1	5.1	4.1	4.1
2	2.85	1.52	0.36	1.35	2.17	1.49	2.85	2.85
3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
4	3.8	5.3	5.3	5.3	5.3	5.3	3.8	3.8
5	2.1	2.6	2.6	2.6	2.6	3.4	2.1	2.1
6	2.7	3.5	3.5	3.5	3.5	3.5	2.7	2.7
7	3.2	4.25	4.25	4.25	4.25	4.25	3.2	3.2
8	2.0	3.3	3.3	3.3	3.3	3.3	2.0	2.0

**For 2.4GHz function:**

For IEEE 802.11 b/g/n/ax mode (1TX/1RX)

Ant. 1 ~ Ant. 8 could transmit/receive.

**For 5GHz function:**

For IEEE 802.11 a/n/ac/ax mode (1TX/1RX)

Ant. 1 ~ Ant. 8 could transmit/receive.

**For BT function:**

For IEEE 802.15.1 Bluetooth mode (1TX/1RX)

Ant. 1 ~ Ant. 8 could transmit/receive.

**For Zigbee function:**

For IEEE 802.15.4 mode (1TX/1RX)

Ant. 1 ~ Ant. 8 could transmit/receive.

### 1.1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description	Chipset used	Radio Technologies	Antenna Type	Antenna item
MAYA-W476-00B	Product with integrated antenna	NXP IW610G	2.4G+5G Wi-Fi, BLE, 802.15.4	PCB Antenna	W9
MAYA-W466-00B	Product with integrated antenna	NXP IW610F	2.4G+5G Wi-Fi, BLE	PCB Antenna	W9
MAYA-W446-00B	Product with integrated antenna	NXP IW610C	2.4G Wi-Fi, BLE, 802.15.4	PCB Antenna	W9
MAYA-W436-00B	Product with integrated antenna	NXP IW610B	2.4G Wi-Fi, BLE	PCB Antenna	W9
MAYA-W473-00B	Product with antenna pin	NXP IW610G	2.4G+5G Wi-Fi, BLE, 802.15.4	External Antenna Dual-Band dipole Antenna or External PCB Antenna	W1~8
MAYA-W463-00B	Product with antenna pin	NXP IW610F	2.4G+5G Wi-Fi, BLE	External Antenna Dual-Band dipole Antenna or External PCB Antenna	W1~8
MAYA-W443-00B	Product with antenna pin	NXP IW610C	2.4G Wi-Fi, BLE, 802.15.4	External Antenna Dual-Band dipole Antenna or External PCB Antenna	W1~8
MAYA-W433-00B	Product with antenna pin	NXP IW610B	2.4G Wi-Fi, BLE	External Antenna Dual-Band dipole Antenna or External PCB Antenna	W1~8

From the above models, model: MAYA-W476-00B, MAYA-W473-00B was selected as representative model for the test and its data was recorded in this report.

## 1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 2 Subpart J, section 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310

## 1.3 Testing Location

Test Lab. : Sporton International Inc. Hsinhua Laboratory			
<input type="checkbox"/>	Hsinhua (TAF: 3785)	ADD: No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)	
		TEL: 886-3-327-3456	FAX: 886-3-327-0973
		Test site Designation No. TW3785 with FCC.	
<input checked="" type="checkbox"/>	Wenhua 3rd. (TAF: 3785)	ADD: No. 58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Guishan Dist. Taoyuan City 333, Taiwan (R.O.C.)	
		TEL: 886-3-327-0868	
		Test site Designation No. TW0008 with FCC.	



## 2 Maximum Permissible Exposure

### 2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f <sup>2</sup> )*	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

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	F/1500	30
1500-100,000	-	-	1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

#### Multiple Transmitters Condition

Co-location as simultaneously transmitting (co-transmitting) and the evaluation shall be consider that simultaneous transmissions from co-located devices the individual transmitters are evaluated separately. After sum of the individual value (basic restriction / reference level) are measured/calculated also have to under basic restriction / reference level.

Co-transmitting mode:

1. WLAN 5GHz+Bluetooth
2. WLAN 5GHz+802.15.4

## 2.2 RF Exposure Exempt Measurement

Option	Refer Std.	Exemption Exposure Thresholds (TL)
A	§1.1307(b)(3)(i)(A)	Available maximum time-averaged power is no more than 1 mW
B	§1.1307(b)(3)(i)(B)	$P_{th}(mW) = \begin{cases} ERP_{20cm}(d / 20cm)^x \rightarrow d \leq 20cm \\ ERP_{20cm} \rightarrow 20cm < d \leq 40cm \end{cases}$ $x = -\log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz}$ $\begin{cases} ERP_{20cm} : 0.3GHz \leq f < 1.5GHz \rightarrow 2040f(mW) \\ ERP_{20cm} : 1.5GHz \leq f \leq 6GHz \rightarrow 3060(mW) \end{cases}$
C	§1.1307(b)(3)(i)(C)	$\begin{cases} 0.3 \sim 1.34MHz \rightarrow ERP(W) = 1920R^2 \\ 1.34 \sim 30MHz \rightarrow ERP(W) = 3450R^2 / f^2 \\ 30 \sim 300MHz \rightarrow ERP(W) = 3.83R^2 \\ 300 \sim 1500MHz \rightarrow ERP(W) = 0.0128R^2 f \\ 1500 \sim 100000MHz \rightarrow ERP(W) = 19.2R^2 \end{cases}$ <p>f is in MHz; R is in m; <math>R &gt; \lambda / 2\pi</math></p>

## 2.3 Multiple RF Sources Exposure

Refer Std.	Exemption Exposure Thresholds (TL)
§1.1307(b)(3)(ii)(A)	The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required)
§1.1307(b)(3)(ii)(B)	$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{ExposureLimit_k} \leq 1$ <p>a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P , including existing exempt transmitters and those being added.</p> <p>b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.</p> <p>c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.</p> <p><math>P_i</math> = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).</p> <p><math>P_{th,i}</math> = the exemption threshold power ( <math>P_{th}</math> ) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.</p> <p><math>ERP_j</math> = the ERP of fixed, mobile, or portable RF source j.</p> <p><math>ERP_{th,j}</math> = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least <math>\lambda/2\pi</math> according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.</p> <p><math>Evaluated_k</math> = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.</p> <p><math>Evaluated Limit_k</math> = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.</p>



## **2.4 MPE Calculation Method**

The MPE was calculated at 20 cm to show compliance with the power density limit.  
The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

## 2.5 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

**WLAN 2.4GHz**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;G1D	4.10	13.61	15.56	1.50	50.816	20	B	3060.0	0.0166
2.4G;D1D	4.10	20.47	22.42	1.50	246.604	20	B	3060.0	0.0806

**WLAN 5GHz**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
5.2G;D1D	5.30	22.03	25.18	1.50	465.586	20	B	3060.0	0.1522
5.3G;D1D	5.30	21.17	24.32	1.50	381.944	20	B	3060.0	0.1249
5.6G;D1D	5.30	15.66	18.81	1.50	107.399	20	B	3060.0	0.0351
5.8G;D1D	5.30	15.84	18.99	1.50	111.944	20	B	3060.0	0.0366
5.81G;D1D	5.30	16.78	19.93	1.50	138.995	20	B	3060.0	0.0454

**Bluetooth**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;BT-LE	4.10	12.53	14.48	1.50	39.628	20	B	3060.0	0.0130

**802.15.4**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	4.10	12.74	14.69	1.50	41.591	20	B	3060.0	0.0136

Note 1: Option A, B and C refer as clause 2.2

Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)

Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)



## Simultaneous Transmission Analysis Mode:

## WLAN 5GHz+Bluetooth

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
5.3G:D1D	5.30	21.17	24.32	1.50	381.944	20	B	3060.0	0.1249
2.4G:BT-LE	4.10	12.53	14.48	0.50	31.477	20	B	3060.0	0.0103
Sum Ratio	0.1352								
Ratio Limit	1.00000								

## WLAN 5GHz+802.15.4

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
5.3G:D1D	5.30	21.17	24.32	1.50	381.944	20	B	3060.0	0.1249
2.4G:D1D	4.10	12.74	14.69	1.50	41.591	20	B	3060.0	0.0136
Sum Ratio	0.1385								
Ratio Limit	1.00000								

Note 1: Option A, B and C refer as clause 2.2

Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)

Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)

Note 4: Refer as clause 2.3 Multiple RF Sources Exposure. Please follow below option and sum TL ration table.

Option	Sum TL Ratio_B	Option	Sum TL Ratio_C	Option	Sum TL Ratio_E
B	$\sum_{i=1}^a \frac{P_i}{P_{th,i}}$	C	$\sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}}$	E	$\sum_{k=1}^c \frac{Evaluated_k}{ExposureLimit_k}$

Note: The above antenna gain was declared by manufacturer.

—————THE END—————