RF Exposure Evaluation Declaration

FCC ID:	TV7L23AX52
Applicant:	Mikrotikls SIA
Product:	mANTBox ax 15s L23UGSR-5HaxD2HaxD-US NetMetal ax
Model No.:	L22UGS-5HaxD2HaxD-15S-US L23UGSR-5HaxD2HaxD-US L23UGSR-5HaxD2HaxD-NM-US
Brand Name:	MikroTik
FCC Rule Part(s):	FCC Part 2.1091
Evaluation Date:	2024-02-04
Result:	Complies

Reviewed By: Vincent Yu

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2308RSU089-U4	V01	Initial Report	2024-02-20	Valid

CONTENTS

1. General Information

1.1. Applicant

Mikrotikls SIA

Ūnijas iela 2, Riga, LV-1039 LATVIA

1.2. Manufacturer

Mikrotikls SIA

Ūnijas iela 2, Riga, LV-1039 LATVIA

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: 3261				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	mANTBox ax 15s L23UGSR-5HaxD2HaxD-US NetMetal ax
Model No.	L22UGS-5HaxD2HaxD-15S-US L23UGSR-5HaxD2HaxD-US L23UGSR-5HaxD2HaxD-NM-US
EUT Serial No.	L23UGSR-5HaxD2HaxD-US: HEM08J6X3F6/320 L23UGSR-5HaxD2HaxD-NM-US: HER09ACK29G/332 L22UGS-5HaxD2HaxD-15S-US: HFB01P06YS3
Wi-Fi Specification	802.11a/b/g/n/ac/ax, VHT
Antenna Information	Refer to section 1.5
Working Voltage	AC Adapter Input or PoE Input
Operating Temperature	-40 ~ 70℃
Accessories	
AC Adapter	Model No.: SAW30-240-1200G Input Power: 100 - 240V ~ 50/60Hz, 0.8A Output Power: 24.0V ⎓ 1.2A 28.8W
Gigabit PoE	Input: 18-57V PIN 4, 5: 18-57V PIN 7, 8 Return

Remark:

1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.
2. PoE needs to be used with an AC adapter. For this report, we select AC Adapter for testing.
3. For model differences, please refer to the Operation Description document.

1.5. Antenna Details

Antenna Type	Antenna Model	Frequency Range (MHz)	Max. PK Gain (dBi)	CDD DG (dBi)	
				For Power	For PSD
Omni Antenna	HGO-antenna-OUT	2400 ~ 2483.5	3.3	3.3	6.31
		5150 ~ 5850	7.1	7.1	10.11
Sector Antenna	MTAS-5G-19D120	5150 ~ 5850	19.0	19.0	22.01
Integral Antenna	Built-in cross-polarized sector antenna	2400 ~ 2483.5	12.0	12.0	15.01
		5150 ~ 5850	14.0	14.0	17.01

Notes:

1. The EUT only supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.
2. The antenna specification is provided by the applicant.

Optional Antenna	L23UGSR-5HaxD2HaxD-US	L23UGSR-5HaxD2HaxD-NM-US	L22UGS-5HaxD2HaxD-15S-US
Omni Antenna	☒	☒	☐
Sector Antenna	☒	☒	☐
Integral Antenna	☐	☐	☒

Note: The model L23UGSR-5HaxD2HaxD-US and L23UGSR-5HaxD2HaxD-NM-US can be equipped with 2 external antennas, and model L22UGS-5HaxD2HaxD-15S-US only have one built-in antenna.

1.6. Device Classification

According to the operating environment and product manual, this device is classified as a fixed installation equipment. Therefore, the RF exposure assessment requirements in § 2.1091 are used to evaluate MPE.

1.7. Applied Standards

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

- FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01

2. RF Exposure Evaluation

2.1. Test Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500	--	--	f/300	<6
1,500-100,000	--	--	5	<6
(B) Limits for General Population/ Uncontrolled Exposures				
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
300-1,500	--	--	f/1500	<30
1,500-100,000	--	--	1.0	<30

f= frequency in MHz. * = Plane-wave equivalent power density.

2.2. MPE Exemptions

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

(Option A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.
Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

(Option B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (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 is given by:

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}(d\,/\,20cm)^{x}}$ d ≤ 20cm

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}}$ 20cm < d ≤ 40cm

Where

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

and

$\mathrm{ERP_{20cm}(mW)} = \{2040\mathrm{f}$ 0.3GHz ≤ f < 1.5GHz

$\mathrm{ERP_{20cm}(mW)} = \{3060$ 1.5GHz ≤ f ≤ 6GHz

(Option C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1920R^2$
1.34-30	$3450R^2/f^2$
30-300	$3.83R^2$
300-1,500	$0.0128R^2f$
1,500-100,000	$19.2R^2$

For multiple RF sources: Multiple RF sources are exempt if:

(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). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

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.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

P_i = 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).

$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i*.

ERP_j = the ERP of fixed, mobile, or portable RF source *j*.

ERP$_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j*, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

Evaluated$_k$ = 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.

Exposure Limit$_k$ = 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.

2.3. Calculated Result

Test Mode	Frequency Band (MHz)	Max. Total Conducted Power (dBm)	Antenna Gain (dBi)	Max. ERP (dBm)
VHT, 802.11b/g/n/ax	2412 ~ 2462	23.89	12.0	33.74
802.11a/n/ac/ax	5180 ~ 5240	6.88	14.0	18.73
	5260 ~ 5320	15.86	14.0	27.71
	5500 ~ 5720	15.57	14.0	27.42
	5745 ~ 5825	16.8	19.0	33.65

For single RF source, Option C

Test Mode	λ / 2 π (m)	R (m)	Max. ERP (mW)	Thresholds ERP (mW)
Wi-Fi (DTS)	0.0198	0.49	2365.9	4800.0
Wi-Fi (NII)	0.0092	0.49	2317.4	4800.0

Note: R is from user manual.

For multiple RF sources

The 2.4GHz Wi-Fi and 5GHz Wi-Fi can transmit simultaneously, so the Max Simultaneous Transmission = 2365.9/4800.0 (DTS) + 2317.4/4800.0 (NII) = 0.9757 < 1

Therefore, the device qualifies for RF exposure test exemption.

The End