



# RF EXPOSURE EVALUATION REPORT

**APPLICANT** : MiMOMax Wireless Limited  
**PRODUCT NAME** : 900MHz TornadoXR Transceiver  
**MODEL NAME** : MWL-TORNADOX-\*G\*A/B/C  
**BRAND NAME** : MiMOMax Wireless  
**FCC ID** : XMK-MMXTRNXB005  
**STANDARD(S)** : FCC 47 CFR Part 2(2.1091)  
FCC 47 CFR Part 24(24.52)  
**RECEIPT DATE** : 2022-11-30  
**TEST DATE** : 2023-01-10 to 2023-09-21  
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Change History		
Version	Date	Reason for Change
1.0	2023-11-09	First edition



# 1. Technical Information

**Note:** Provide by applicant.

## 1.1 Applicant and Manufacturer Information

<b>Applicant:</b>	MiMOMax Wireless Limited
<b>Applicant Address:</b>	540 Wairakei Road, Christchurch 8053, New Zealand
<b>Manufacturer:</b>	MiMOMax Wireless Limited
<b>Manufacturer Address:</b>	540 Wairakei Road, Christchurch 8053, New Zealand

## 1.2 Equipment under Test (EUT) Description

<b>Product Name:</b>	900MHz TornadoXR Transceiver	
<b>Serial No.:</b>	(N/A, marked 1# by test site)	
<b>Hardware Version:</b>	P001	
<b>Software Version:</b>	TRN_04.08.00.HPT76	
<b>Frequency Bands:</b>	901 MHz – 902 MHz; 930 MHz – 931 MHz; 940 MHz – 941 MHz	
<b>Modulation Type:</b>	QPSK, 16QAM, 64QAM, 256QAM	
<b>Channel Bandwidth:</b>	12.5kHz, 25kHz, 50kHz	
<b>Antenna Type:</b>	Omni Antenna, Panel Antenna	
<b>Antenna Gain:</b>	Omni Antenna	2.5 dBi
		4.0 dBi
		6.0 dBi
	Panel Antenna	8.0 dBi
		10.0 dBi
		12.0 dBi
		16.0 dBi

**Note:**

1. This report was updated based on the original report SZ22110153S01, Model: MWL-TORNADOX-\*G\*A/B/C, both of them are different from changing 901-902 RF power through software, adding a 6dBi antenna and applying for new FCC ID certification. Therefore, we need to reassess the MPE and its latest results will be recorded in this report.
2. When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% Confidence intervals.



### 1.3 Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method Determination /Remark
FCC 47 CFR Part 2(2.1091)	Radio Frequency Radiation Exposure Assessment: mobile devices	No deviation
FCC 47 CFR Part 24(24.52)	RF Exposure	No deviation
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
<b>Note 1:</b> Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		



## 2. RF Exposure Limit

Per user manual, Based on 47CFR 2.1091, this device belongs to mobile device category with General Population/Uncontrolled exposure.

### Mobile Devices:

47CFR 2.1091(b)

For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

### General Population/Uncontrolled Exposure:

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

**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 <sup>2</sup> )	Averaging time (minutes)
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
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

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

### 3. RF Output Power

901.50 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	27.50	28.50	28.20	28.50
	16QAM	27.73	28.50	28.07	28.50
	64QAM	27.81	28.50	28.21	28.50
	256QAM	27.91	28.50	27.93	28.50
25.0	QPSK	28.13	28.50	27.85	28.50
	16QAM	27.81	28.50	28.00	28.50
	64QAM	27.95	28.50	27.93	28.50
	256QAM	28.02	28.50	27.94	28.50
50.0	QPSK	28.03	28.50	27.66	28.50
	16QAM	27.82	28.50	28.13	28.50
	64QAM	28.06	28.50	27.84	28.50
	256QAM	28.11	28.50	27.73	28.50

901.50 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	34.05	35.00	34.25	35.00
	16QAM	34.01	35.00	34.20	35.00
	64QAM	34.18	35.00	34.31	35.00
	256QAM	34.21	35.00	34.34	35.00
25.0	QPSK	34.00	35.00	34.15	35.00
	16QAM	34.11	35.00	34.22	35.00
	64QAM	34.24	35.00	34.39	35.00
	256QAM	34.30	35.00	34.53	35.00
50.0	QPSK	33.79	34.50	34.14	35.00
	16QAM	33.71	34.50	34.12	35.00
	64QAM	33.81	34.50	34.26	35.00
	256QAM	33.91	34.50	34.32	35.00



930.50 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	33.64	34.50	33.76	34.50
	16QAM	33.66	34.50	33.79	34.50
	64QAM	33.73	34.50	33.98	34.50
	256QAM	34.00	34.50	34.06	34.50
25.0	QPSK	33.24	34.50	33.41	34.50
	16QAM	33.22	34.50	33.42	34.50
	64QAM	33.44	34.50	33.59	34.50
	256QAM	33.45	34.50	33.63	34.50
50.0	QPSK	33.93	34.50	34.12	34.50
	16QAM	33.90	34.50	<b>34.60</b>	35.00
	64QAM	34.25	34.50	34.28	34.50
	256QAM	34.32	34.50	34.28	34.50

940.50 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	33.60	34.50	33.82	34.50
	16QAM	33.62	34.50	33.72	34.50
	64QAM	33.84	34.50	33.81	34.50
	256QAM	33.72	34.50	33.77	34.50
25.0	QPSK	33.27	34.50	33.40	34.50
	16QAM	33.34	34.50	33.33	34.50
	64QAM	33.40	34.50	33.53	34.50
	256QAM	33.70	34.50	33.51	34.50
50.0	QPSK	33.83	34.50	34.19	34.50
	16QAM	33.78	34.50	34.08	34.50
	64QAM	34.08	34.50	34.21	34.50
	256QAM	34.17	34.50	34.25	34.50

**Note 1:** According to KDB 447498 Section 4.3, MPE assessment is based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

**Note 2:** The output power refers to report (Report No.: SZ23090110W01/02).

## 4. RF Exposure Assessment

### ➤ Requirement

3. Per 47 CFR Part 1.1310 transmitters are required to be operated in a manner that ensures the public is not exposed to RF energy levels in accordance with OST/OET Bulletin Number 65.
4. General Population/Uncontrolled RF exposure should be limited to **0.620 mW/cm<sup>2</sup>→6.20 W/m<sup>2</sup>** (f/1500 = 930.50 MHz/1500) for this device according to 47 CFR Part 1.1310, and the power density calculation should be followed **S (W/m<sup>2</sup>) = E<sup>2</sup>/377, E=48.36 V/m.**
5. The minimum distance from the antenna at which the MPE is met and calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain, transmitter duty cycle and separation distance in meters: **E (V/m) = [√(30 \* P \* G)] / d.**
6. A duty cycle of 100% as the transmitter means a base station could possibly be operated for long periods of time, therefore the duty cycle factor of 1.0 should be applied.

### ➤ Radio Safety

The client has declared that this transmitter can be operated using a range of antennas with various gains, as detailed in the table below:

Frequency Bands	Maximum Power (dBm)	Antenna Gain (dBi)	Safe Distance (m)	Safe Distance (cm)
930.50 MHz	35.00	2.5	0.27	27
930.50 MHz	35.00	4.0	0.32	32
930.50 MHz	35.00	6.0	0.41	41
930.50 MHz	35.00	8.0	0.51	51
930.50 MHz	35.00	10.0	0.64	64
930.50 MHz	35.00	12.0	0.81	81
930.50 MHz	35.00	16.0	1.28	128

### Note:

1. According to KDB 447498, SAR test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for tune-up tolerance, and the minimum test separation distance of 27cm is required for the exposure conditions.
2. The safe distance calculation should be followed:  

$$E (V/m) = [\sqrt{(30 * P * G * \text{Duty Cycle Factor})}] / d.$$

### ➤ Conclusion:

Complies if the safe distances defined above are applied.





## Annex A Testing Laboratory Information

### 1. Identification of the Responsible Testing Laboratory

<b>Laboratory Name:</b>	Shenzhen Morlab Communications Technology Co., Ltd.
<b>Laboratory Address:</b>	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
<b>Telephone:</b>	+86 755 36698555
<b>Facsimile:</b>	+86 755 36698525

### 2. Identification of the Responsible Testing Location

<b>Name:</b>	Shenzhen Morlab Communications Technology Co., Ltd.
<b>Address:</b>	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

### 3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

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