REPORT No.: SZ21010246S01

RF EXPOSURE EVALUATION REPORT

APPLICANT	:	MiMOMax Wireless Limited
PRODUCT NAME	:	700MHz Upper A Block Tornado Transceiver
MODEL NAME	:	MWL-TORNADO-*H A/B/C *
BRAND NAME	:	MiMOMax Wireless
FCC ID	:	XMK-MMXTRNB006
STANDARD(S)	:	FCC 47CFR Part 2(2.1091) FCC 47CFR Part 27(27.52)
RECEIPT DATE	:	2021-02-22
TEST DATE	:	2021-03-02 to 2021-04-26
ISSUE DATE	:	2021-05-06

Edited by: Zeng Xiaoying (Rapporteur)

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DIRECTORY

Change History		
Version	**Date**	**Reason for Change**
1.0	2021-05-06	First edition

1. Technical Information

Note: Provide by applicant.

1.1 Applicant and Manufacturer Information

Applicant:	MiMOMax Wireless Limited
Applicant Address:	540 Wairakei Road, Christchurch 8053, New Zealand
Manufacturer:	MiMOMax Wireless Limited
Manufacturer Address:	540 Wairakei Road, Christchurch 8053, New Zealand

1.2 Equipment under Test (EUT) Description

Product Name:	700MHz Upper A Block Tornado Transceiver	
Serial No.:	(N/A, marked #1 by test site)	
Hardware Version:	P001	
Software Version:	TRN-04.06.02	
Frequency Bands:	757MHz–758MHz; 787MHz–788MHz	
Modulation Type:	QPSK, 16QAM, 64QAM, 256QAM	
Channel Bandwidth:	12.5kHz, 25kHz, 50kHz	
Antenna Type:	Omni Antenna; Panel Antenna; Yagi Antenna	
Antenna Gain:	Omni Antenna	4.0 dBi
		8.0 dBi
	Panel Antenna	8.0 dBi
		9.0 dBi
		11.0 dBi
		12.0 dBi
		16.0 dBi
	Yagi Antenna	12.0 dBi
		15.0 dBi

1.3 Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method Determination /Remark
FCC 47CFR Part 2(2.1091)	Radio Frequency Radiation Exposure Assessment: mobile devices	No deviation
FCC 47CFR Part 27(27.52)	RF Exposure	No deviation
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
Note 1: 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. **Note 2:** When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.		

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^2)	Averaging time (minutes)
(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

3. RF Output Power

757.05 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	24.04	24.50	23.97	24.50
	16QAM	24.02	24.50	23.94	24.50
	64QAM	24.08	24.50	24.01	24.50
	256QAM	24.09	24.50	24.08	24.50
25.0	QPSK	24.04	24.50	23.96	24.50
	16QAM	24.05	24.50	24.01	24.50
	64QAM	24.07	24.50	24.08	24.50
	256QAM	24.09	24.50	24.07	24.50
50.0	QPSK	23.99	24.50	24.00	24.50
	16QAM	24.01	24.50	23.95	24.50
	64QAM	24.08	24.50	23.98	24.50
	256QAM	24.08	24.50	24.04	24.50

787.95 MHz					
BW [kHz]	Modulation	Channel H Power (dBm)	Tune-up Power (dBm)	Channel V Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	23.96	24.50	23.94	24.50
	16QAM	23.93	24.50	23.95	24.50
	64QAM	24.02	24.50	23.93	24.50
	256QAM	24.03	24.50	24.02	24.50
25.0	QPSK	23.97	24.50	24.01	24.50
	16QAM	23.93	24.50	23.91	24.50
	64QAM	23.97	24.50	23.98	24.50
	256QAM	24.04	24.50	23.94	24.50
50.0	QPSK	24.06	24.50	23.97	24.50
	16QAM	24.01	24.50	23.96	24.50
	64QAM	24.05	24.50	23.98	24.50
	256QAM	24.08	24.50	24.05	24.50

757.05 MHz			
BW [kHz]	Modulation	MIMO Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	27.02	27.50
	16QAM	26.99	27.50
	64QAM	27.06	27.50
	256QAM	27.10	27.50
25.0	QPSK	27.01	27.50
	16QAM	27.04	27.50
	64QAM	27.09	27.50
	256QAM	27.09	27.50
50.0	QPSK	27.01	27.50
	16QAM	26.99	27.50
	64QAM	27.04	27.50
	256QAM	27.07	27.50

787.95 MHz			
BW [kHz]	Modulation	MIMO Power (dBm)	Tune-up Power (dBm)
12.5	QPSK	26.96	27.50
	16QAM	26.95	27.50
	64QAM	26.99	27.50
	256QAM	27.04	27.50
25.0	QPSK	27.00	27.50
	16QAM	26.93	27.50
	64QAM	26.99	27.50
	256QAM	27.00	27.50
50.0	QPSK	27.03	27.50
	16QAM	27.00	27.50
	64QAM	27.03	27.50
	256QAM	27.08	27.50

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.: SZ21010246W01).

4. RF Exposure Assessment

➢ **Requirement**

1. 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.
2. General Population/Uncontrolled RF exposure should be limited to **0.505 mW/cm^2→5.05 W/m^2** (f/1500 = 757 MHz/1500) for this device according to 47 CFR Part 1.1310, and the power density calculation should be followed **S (W/m^2) = E^2/377**, **E=43.6 V/m**.
3. 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**.
4. 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)
757.05MHz	24.50	16.00	0.26	26
757.05MHz	24.50	15.00	0.25	25
757.05MHz	24.50	12.00	0.23	23
757.05MHz	24.50	11.00	0.22	22
757.05MHz	24.50	9.00	0.20	20
757.05MHz	24.50	8.00	0.18	18
757.05MHz	24.50	4.00	0.13	13
Frequency Bands	MIMO Power (dBm)	Antenna Gain (dBi)	Safe Distance (m)	Safe Distance (cm)
757.05MHz	27.50	16.00	0.38	38
757.05MHz	27.50	15.00	0.36	36
757.05MHz	27.50	12.00	0.33	33
757.05MHz	27.50	11.00	0.31	31
757.05MHz	27.50	9.00	0.28	28
757.05MHz	27.50	8.00	0.27	27
757.05MHz	27.50	4.00	0.19	19

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 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

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

2. Identification of the Responsible Testing Location

Name:	Morlab Laboratory of Shenzhen Morlab Communications Technology Co., Ltd.
Address:	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 C63.10-2013and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

END OF REPORT