



# RF EXPOSURE EVALUATION REPORT

**APPLICANT** : Thundercomm Technology Co., Ltd.  
**PRODUCT NAME** : Thundersoft TurboX S820 SOM  
**MODEL NAME** : S820  
**BRAND NAME** : TurboX  
**FCC ID** : 2AOHHTURBOXSOMS820  
**STANDARD(S)** : 47CFR 2.1091  
KDB 447498  
**ISSUE DATE** : 2018-01-02

Tested by: Peng Fuwei  
Peng Fuwei (Test engineer)

Approved by: Peng Huarui  
Peng Huarui (Supervisor)

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Change History		
Issue	Date	Reason for change
1.0	2018-01-02	First edition



# 1. Technical Information

**Note:** Provide by manufacturer.

## 1.1 Applicant and Manufacturer Information

<b>Applicant:</b>	Thundercomm Technology Co., Ltd.
<b>Applicant Address:</b>	4F,Taixiang Building, 1A Longxiang Rd., Haidian Dist., Beijing,100191,P.R.China
<b>Manufacturer:</b>	Thundercomm Technology Co., Ltd.
<b>Manufacturer Address:</b>	4F,Taixiang Building, 1A Longxiang Rd., Haidian Dist., Beijing,100191,P.R.China

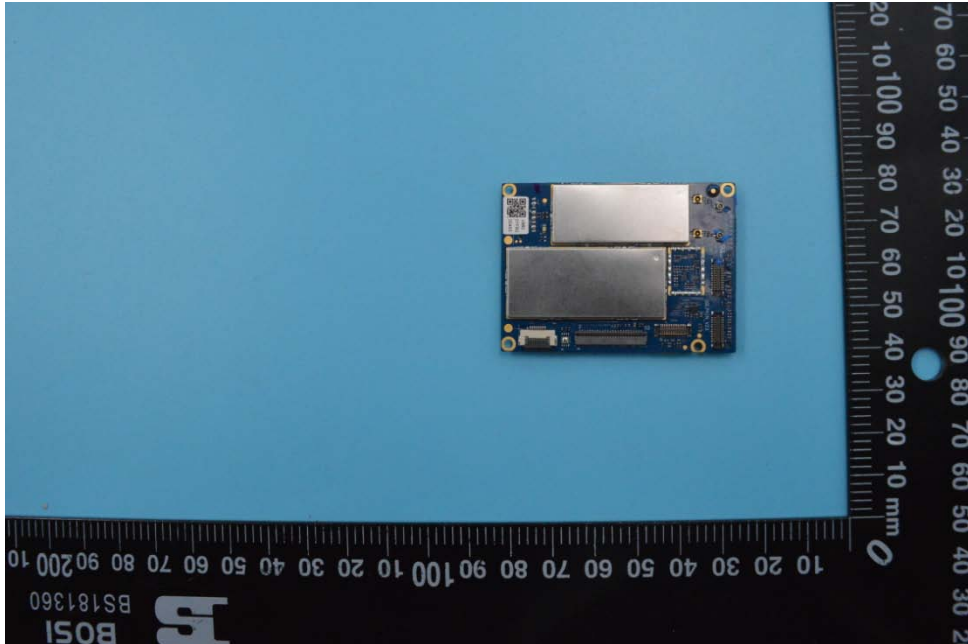
## 1.2 Equipment Under Test (EUT) Description

<b>EUT Type:</b>	Thundersoft TurboX S820 SOM
<b>Hardware Version:</b>	Dolphin_V23
<b>Software Version:</b>	N/A
<b>Frequency Bands:</b>	WLAN 2.4G:802.11b/g/n-20MHz: 2.412GHz - 2.462GHz; 802.11n-40MHz: 2.422GHz - 2.452GHz; WLAN 5.2G : 5.150GHz- 5.250GHz; WLAN 5.8G : 5.725GHz- 5.850GHz; Bluetooth 4.2 LE:2402MHz - 2480MHz; Bluetooth 4.2(BR/EDR): 2402MHz - 2480MHz;
<b>Modulation Mode:</b>	WLAN 2.4GHz:802.11b/g/n HT-20/HT-40 ; WLAN 5GHz: 802.11a, 802.11n(HT20), 802.11n(HT40), 802.11ac(VHT20), 802.11ac(VHT40), 801.11ac(VHT80) ; Bluetooth 4.2 LE: GFSK; Bluetooth 4.2(BR/EDR): FHSS (GFSK(1Mbps), $\pi/4$ -DQP SK(EDR 2Mbps), 8-DPSK(EDR 3Mbps)) ;
<b>Antenna type:</b>	FPC Antenna
<b>Antenna gain:</b>	Ant0:4 dBi; Ant1:4 dBi

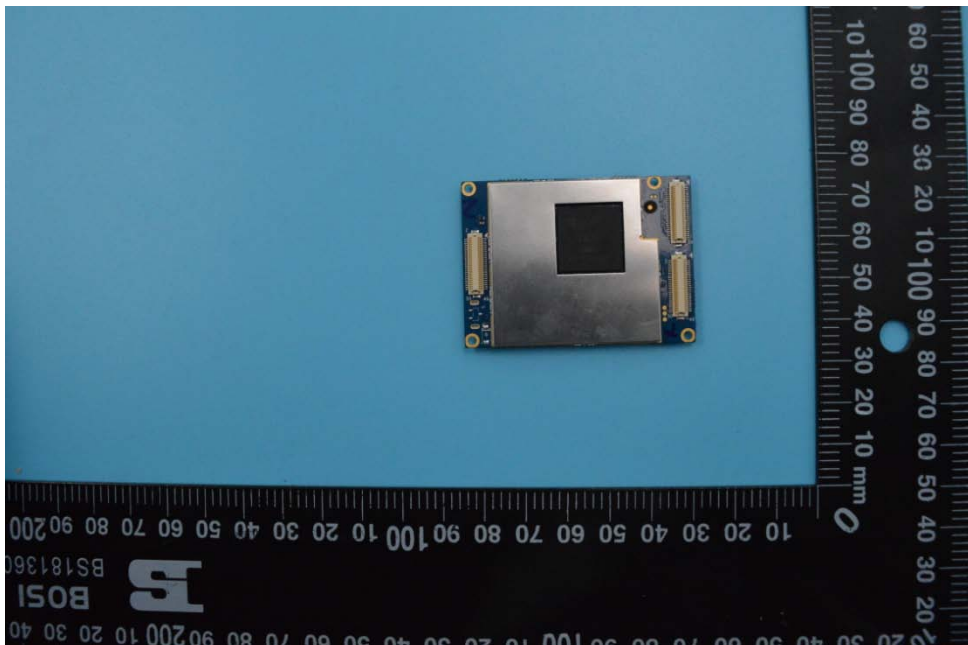
Note 1: The product will not sell with antenna. The antennas we use for all radiated test were just for test, the antenna type is external antenna and the antenna gain is 4 dBi. For more detailed, please refer to the Internal Photos.

### 1.3 Photographs of the EUT

#### 1. EUT front view



#### 2. EUT rear view





### 1.3.1 Identification of all used EUT

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

<b>EUT Identity</b>	<b>Hardware Version</b>	<b>Software Version</b>
1#	Dolphin_V23	N/A

## 1.4 Applied Reference Documents

Leading reference documents for testing:

<b>No.</b>	<b>Identity</b>	<b>Document Title</b>
1	47 CFR§2.1091	Radio frequency Radiation Exposure Evaluation: mobile devices
2	KDB 447498 D01v06	General RF Exposure Guidance



## 2. Device Category And 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. Measurement Of conducted Peak Output Power

#### 1. Bluetooth Peak output power

Band	Channel	Frequency (MHz)	Output Power(dBm)		
			GFSK	$\pi/4$ -DQPSK	8-DPSK
BT 4.2+EDR	0	2402	9.78	8.44	8.68
	39	2441	10.01	8.70	8.92
	78	2480	8.90	7.64	7.90

Band	Channel	Frequency (MHz)	Output Power(dBm)
			GFSK
BT4.2	0	2402	-1.10
	19	2440	-0.74
	39	2480	-1.40

#### 2. Wifi Peak output power

Band	Channel	Frequency (MHz)	802.11b	
			ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
Wifi 2.4G	1	2412	16.63	16.53
	6	2437	16.51	16.47
	11	2462	16.72	16.63

Band	Channel	Frequency (MHz)	802.11g	
			ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
Wifi 2.4G	1	2412	19.51	19.53
	6	2437	19.53	19.37
	11	2462	19.57	19.48



Band	Channel	Frequency (MHz)	802.11n-20MHz	
			ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
Wifi 2.4G	1	2412	19.85	19.78
	6	2437	19.83	19.83
	11	2462	19.78	19.75

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11n-20MHz
Wifi 2.4G	1	2412	22.83
	6	2437	22.84
	11	2462	22.78

Band	Channel	Frequency (MHz)	802.11n-40MHz	
			ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
Wifi 2.4G	3	2422	20.27	20.21
	6	2437	20.53	20.47
	9	2452	20.18	20.46

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11n-40MHz
Wifi 2.4G	1	2412	23.25
	6	2437	23.51
	11	2462	23.33





Band	Channel	Frequency (MHz)	ANT0 Measured Peak Power (dBm)		ANT1 Measured Peak Power (dBm)	
			802.11a	802.11n20	802.11a	802.11n20
Wifi 5.2G	36	5180	16.05	15.88	16.14	15.78
	44	5220	15.83	16.26	15.78	16.23
	48	5240	15.80	16.26	15.63	16.24
Wifi 5.8G	149	5745	18.77	18.96	18.78	18.78
	157	5785	18.35	18.72	18.27	18.65
	165	5825	18.63	18.77	18.56	18.75

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)	
			802.11a	802.11n20
Wifi 5.2G	36	5180	19.11	18.89
	44	5220	18.82	19.27
	48	5240	18.73	19.27
Wifi 5.8G	149	5745	21.79	21.88
	157	5785	21.32	21.70
	165	5825	21.61	21.77

Band	Channel	Frequency (MHz)	ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
			802.11n40	802.11n40
Wifi 5.2G	38	5190	19.39	19.47
	46	5230	19.81	19.68
Wifi 5.8G	151	5755	19.53	19.45
	159	5795	19.38	19.31



Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11n40
Wifi 5.2G	38	5190	22.40
	46	5230	22.82
Wifi 5.8G	151	5755	22.54
	159	5795	22.39

Band	Channel	Frequency (MHz)	ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
			802.11 ac (VHT20)	802.11 ac (VHT20)
Wifi 5.2G	36	5180	15.76	15.81
	44	5220	16.02	16.08
	48	5240	16.25	16.17
Wifi 5.8G	149	5745	18.87	18.76
	157	5785	18.78	18.80
	165	5825	18.87	18.63

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11 ac (VHT20)
Wifi 5.2G	36	5180	18.80
	44	5220	19.06
	48	5240	19.22
Wifi 5.8G	149	5745	21.83
	157	5785	21.80
	165	5825	21.76



Band	Channel	Frequency (MHz)	ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
			802.11 ac (VHT40)	802.11 ac (VHT40)
Wifi 5.2G	38	5190	19.46	19.43
	46	5230	19.71	19.74
Wifi 5.8G	151	5755	19.36	19.25
	159	5795	19.27	19.23

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11 ac (VHT40)
Wifi 5.2G	38	5190	22.46
	46	5230	22.74
Wifi 5.8G	151	5755	22.32
	159	5795	22.26

Band	Channel	Frequency (MHz)	ANT0 Measured Peak Power (dBm)	ANT1 Measured Peak Power (dBm)
			802.11 ac (VHT80)	802.11 ac (VHT80)
Wifi 5.2G	42	5210	18.92	19.76
Wifi 5.8G	155	5775	18.59	18.63

Band	Channel	Frequency (MHz)	ANT0+ ANT1 Total Peak Power (dBm)
			802.11 ac (VHT80)
Wifi 5.2G	42	5210	21.93
Wifi 5.8G	155	5775	21.60



## 4. RF Exposure Evaluation

### Standalone transmission MPE evaluation

Bands	Frequency (MHz)	Antenna Gain (dBi)	Conducted Peak Power (dBm)	EIRP (mW)	Power density (mW/cm <sup>2</sup> )	Limit for MPE (mW/cm <sup>2</sup> )
BT4.2+EDR	2441	4	10.01	25.177	0.005	1.0
BT4.2	2440	4	-0.74	2.118	0.0004	1.0
2.4GHz ANT0	2437	4	20.53	283.792	0.056	1.0
2.4GHz ANT1	2437	4	20.47	279.898	0.056	1.0
2.4GHz ANT0+ANT1	2437	4	23.51	563.638	0.112	1.0
5.2GHz ANT0	5230	4	19.81	240.436	0.048	1.0
5.8GHz ANT0	5755	4	19.53	225.424	0.045	1.0
5.2GHz ANT1	5210	4	19.76	237.684	0.047	1.0
5.8GHz ANT1	5755	4	19.45	221.309	0.044	1.0
5.2GHz ANT0+ANT1	5230	4	22.82	480.839	0.096	1.0
5.8GHz ANT0+ANT1	5755	4	22.54	450.817	0.090	1.0

#### 1. MPE calculation method

$$\text{Power Density} = \text{EIRP}/4\pi R^2$$

Where:  $\text{EIRP} = P \cdot G$

P = Peak out power

G = Antenna gain

R = Separation distance (20cm)



## Annex A General Information

### 1. Identification of the Responsible Testing Laboratory

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

### 2. Identification of the Responsible Testing Location

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

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