



Maximum Permissible Exposure Evaluation

FCC ID: 2BAQT-ITRONCAM**IC: 30320-ITRONCAM**

1. Client Information

Applicant	:	iTronics Limited
Address	:	PO BOX 303 264, North Harbour, Auckland 0751, New Zealand
Manufacturer	:	iTronics Limited
Address	:	PO BOX 303 264, North Harbour, Auckland 0751, New Zealand

2. General Description of EUT

EUT Name	:	iTronCAM
HVIN/Models No.	:	iTronCAM
Model Difference	:	----
Sample ID	:	RW-C-202209-0147-4-1#&RW-C-202209-0147-4-2#
Product Description	:	Operation Frequency: Bluetooth 5.2(BLE): 2402MHz~2480MHz 802.11b/g/n(HT20): 2412MHz~2462MHz
	:	Antenna Gain: 0.5dBi PCB Antenna for Bluetooth 2.35dBi Steel plate Antenna for 2.4G WIFI
Power Rating	:	USB Input: DC5V/1.5A DC 3.7V by 5200mAh Li-ion battery
Software Version	:	----
Hardware Version	:	----
Connecting I/O Port(S)	:	Please refer to the User's Manual
Remark	:	the MPE report used the EUT-2(RW-C-202209-0147-4-2#).

Method of Measurement for FCC

1. EUT Operation Condition:

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

2. Exposure Evaluation:

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=(PG)/4\pi R^2$$

Where

S: power density

P: power input to the antenna

G: power gain of the antenna in the direction of interest relative to an isotropic radiator.

R: distance to the center of radiation of the antenna

3. Simultaneous transmission MPE Considerations

According to KDB447498: All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 .

This means that:

\sum of MPE ratios ≤ 1.0



4. Standalone MPE Evaluation:

Bluetooth LE Worst Maximum MPE Result								
Mode	N _{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/ cm ²) [S]
GFSK (1Mbps)	1	2402	-2.52	-2±1	-1	0.5	20	0.00018
		2440	-2.83	-2±1	-1	0.5	20	0.00018
		2480	-3.48	-3±1	-2	0.5	20	0.00014
Note: N _{TX} = Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.								

2.4G WiFi Worst Maximum MPE Result								
Mode	N _{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/ cm ²) [S]
802.11b	1	2412	17.87	17±1	18	2.35	20	0.02156
		2437	17.98	17±1	18	2.35	20	0.02156
		2462	17.31	17±1	18	2.35	20	0.02156
802.11g	1	2412	17.40	17±1	18	2.35	20	0.02156
		2437	17.02	17±1	18	2.35	20	0.02156
		2462	17.34	17±1	18	2.35	20	0.02156
802.11n (HT20)	1	2412	16.40	16±1	17	2.35	20	0.01713
		2437	16.04	16±1	17	2.35	20	0.01713
		2462	16.23	16±1	17	2.35	20	0.01713
Note: N _{TX} = Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.								

Remark:

1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.
4. Only the worst power was evaluated for each wireless function



5. Conclusion:

As specified in Table 1B of 47 CFR 1.1310- Limits for Maximum Permissible Exposure (MPE),

Limits for General Population/ Uncontrolled Exposure

Frequency Range (MHz)	Power density (mW/ cm ²)
300-1,500	F/1500
1,500-100,000	1.0

6. Summary simultaneous transmission information

The sample supports two antennas for Bluetooth Antenna and WIFI Antenna.

The Bluetooth Antenna and WIFI Antenna can transmit simultaneous.

The Bluetooth Antenna and WIFI Antenna with two different Antenna. According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

Σ of MPE ratios ≤ 1.0

7. Summary simultaneous transmission results

Bluetooth Antenna + WIFI Antenna Maximum Simultaneous transmission MPE Ratios is

$0.00018+0.02156=0.02174 \leq 1.0$.

8. Conclusion:

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

Note

For a more detailed features description, please refer to the RF Test Report.



Method of Measurement for IC

1. Applicable Standard

[Radio Standards Specification 102](#), Radio Frequency (RF) Exposure Compliance of Radio Communication Apparatus (All Frequency Bands), sets out the requirements and measurement techniques used to evaluate radio frequency (RF) exposure compliance of radio communication apparatus designed to be used within the vicinity of the human body.

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

2. Evaluation Method and Limit

According to RSS-102 §4 Table 4, RF Filed Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Frequency Band	f (MHz)	Limit of Power Density (W/m ²)
2.4G WLAN	2412	5.37
Bluetooth	2402	5.35

Note: Limit=0.02619 $f^{0.6834}$ (where f is in MHz).
The f in the limit is the frequency of the lowest Channel.



3. Calculation Formula

Prediction of power density at the distance of the applicable MPE limit:

$$S = \frac{PG}{4\pi R^2} = \text{Power density (in appropriate units, e.g. W/m}^2\text{)}$$

P=power input to antenna (in appropriate units, e.g. W)

G=power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R=distance to the center of radiation of the antenna (in appropriate units, e.g. m)

Simultaneous transmission MPE Considerations

According to KDB447498: All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 .

This means that:

$$\sum \text{ of MPE ratios } \leq 1.0$$



4. Standalone MPE Evaluation:

Bluetooth LE Worst Maximum MPE Result(RTL8723DS)								
Mode	N _{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (W/m ²) [S]
GFSK (1Mbps)	1	2402	-2.52	-2±1	-1	0.5	20	0.0018
		2440	-2.83	-2±1	-1	0.5	20	0.0018
		2480	-3.48	-3±1	-2	0.5	20	0.0014
Note: N _{TX} = Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.								

2.4G WiFi Worst Maximum MPE Result								
Mode	N _{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (W/m ²) [S]
802.11b	1	2412	17.87	17±1	18	2.35	20	0.2156
		2437	17.98	17±1	18	2.35	20	0.2156
		2462	17.31	17±1	18	2.35	20	0.2156
802.11g	1	2412	17.40	17±1	18	2.35	20	0.2156
		2437	17.02	17±1	18	2.35	20	0.2156
		2462	17.34	17±1	18	2.35	20	0.2156
802.11n (HT20)	1	2412	16.40	16±1	17	2.35	20	0.1713
		2437	16.04	16±1	17	2.35	20	0.1713
		2462	16.23	16±1	17	2.35	20	0.1713
Note: N _{TX} = Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.								



Maximum Simultaneous transmission MPE Ratios for Bluetooth Antenna and WIFI Antenna support

Maximum MPE ratio Bluetooth Antenna	Maximum MPE ratio WIFI Antenna	Σ MPE ratios	Limit	Results
0.00034	0.04015	0.04049	1	PASS

Remark:

1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

Note

For a more detailed features description, please refer to the RF Test Report.

-----END OF THE REPORT-----

