

1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 General Information

Client Information

Applicant: Shenzhen Inrico Electronics Co., Ltd
Address of applicant: 4/F, Building NO.108, High Tech Industrial Park, Guowei Road 72, Luohu District, Shenzhen, China

Manufacturer: Shenzhen Inrico Electronics Co., Ltd
Address of manufacturer: 4/F, Building NO.108, High Tech Industrial Park, Guowei Road 72, Luohu District, Shenzhen, China

General Description of EUT:

Product Name: Intelligent Two Way Radio
Trade Name: Inrico
Model No.: TM-8
Adding Model(s): /
FCC ID: 2AIV6-TM-8
Rated Voltage: DC 12/24V
Battery Capacity: /

Technical Characteristics of EUT:	
2G	
Support Networks:	GPRS
Support Band:	GSM850/PCS1900
Uplink Frequency:	GPRS 850: 824~849MHz GPRS 1900: 1850~1910MHz
Downlink Frequency:	GPRS 850: 869~894MHz GPRS 1900: 1930~1990MHz
Max Tune-Up Output Power:	GSM850: 32.87dBm, GSM1900: 30.09dBm
Type of Modulation:	GMSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: 0.2dBi; GSM1900: 0.7dBi
GPRS Class:	Class 12
3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2, WCDMA Band 5
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz WCDMA Band 5: 869~894MHz
Max Tune-Up Output Power:	WCDMA Band 2: 24.76dBm, WCDMA Band 5: 24.22dBm

Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 0.7dBi, WCDMA Band 5: 0.2dBi
WIFI(2.4G)	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 11b/g/n(HT20) 2422-2452MHz for 11n(HT40)
Max Tune-Up Output Power:	13.49dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11/7
Channel Separation:	5MHz
Type of Antenna:	Integral
Antenna Gain:	1.3dBi
BT	
Bluetooth Version:	V4.0
Frequency Range:	2402-2480MHz
Max Tune-Up Output Power:	2.013dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, Pi/4 QDPSK, 8DPSK
Quantity of Channels:	79/40
Channel Separation:	1MHz/2MHz
Type of Antenna:	Integral
Antenna Gain:	1.3dBi

1.2 Standard Applicable

According to § 1.1307(b)(1) and KDB 447498 D01 General RF Exposure Guidance v06, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

(a) Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

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

1.3 MPE Calculation Method

$$S = (30 * P * G) / (377 * R^2)$$

S = power density (in appropriate units, e.g., mw/cm²)

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

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., cm)

1.4 MPE Calculation Result

GSM850:

Maximum Tune-Up output power: 33.0 (dBm)

Maximum peak output power at antenna input terminal: 1995.26 (mW)

Prediction distance: >20(cm)

Prediction frequency: 824.2(MHz)

Antenna gain: 0.2(dBi)

Directional gain (numeric gain): 1.05

The worst case is power density at prediction frequency at 20cm: 0.417 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 0.549 (mw/cm²)

GSM1900:

Maximum Tune-Up output power: 30.50 (dBm)

Maximum peak output power at antenna input terminal: 1122.02 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1850.2(MHz)

Antenna gain: 0.7(dBi)

Directional gain (numeric gain): 1.17

The worst case is power density at prediction frequency at 20cm: 0.261 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mw/cm²)

WCDMA Band 2:

Maximum Tune-Up output power: 25.0 (dBm)

Maximum peak output power at antenna input terminal: 316.23 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1907.6(MHz)

Antenna gain: 0.7(dBi)

Directional gain (numeric gain): 1.17

The worst case is power density at prediction frequency at 20cm: 0.074 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mw/cm²)

WCDMA Band 5:

Maximum Tune-Up output power: 24.50 (dBm)

Maximum peak output power at antenna input terminal: 281.84 (mW)

Prediction distance: >20(cm)

Prediction frequency: 826.4(MHz)

Antenna gain: 0.2(dBi)

Directional gain (numeric gain): 1.05

The worst case is power density at prediction frequency at 20cm: 0.059 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 0.551 (mw/cm²)

WIFI (2.4G):

Maximum Tune-Up output power: 14.00 (dBm)

Maximum peak output power at antenna input terminal: 25.12 (mW)

Prediction distance: >20(cm)

Prediction frequency: 2462(MHz)

Antenna gain: 1.30(dBi)

Directional gain (numeric gain): 1.35

The worst case is power density at prediction frequency at 20cm: 0.007 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm²)

BT:

Maximum Tune-Up output power: 2.5 (dBm)

Maximum peak output power at antenna input terminal: 1.78 (mW)

Prediction distance: >20(cm)

Prediction frequency: 2480(MHz)

Antenna gain: 1.30(dBi)

Directional gain (numeric gain): 1.35

The worst case is power density at prediction frequency at 20cm: 0.0005 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm²)

Simultaneous Multi-band Transmission:**1. GSM+WIFI:**

$$\text{GSM850+WIFI(2.4G)} = 0.417 \text{ mw/cm}^2 + 0.007 \text{ (mw/cm}^2\text{)} = 0.424 \text{ (mw/cm}^2\text{)} < 0.549 \text{ (mw/cm}^2\text{)}$$

$$\text{GSM1900+WIFI(2.4G)} = 0.261 \text{ mw/cm}^2 + 0.007 \text{ (mw/cm}^2\text{)} = 0.268 \text{ (mw/cm}^2\text{)} < 1.0 \text{ (mw/cm}^2\text{)}$$

2. WCDMA+WIFI:

$$\text{WCDMA Band 2+WIFI(2.4G)} = 0.074 \text{ mw/cm}^2 + 0.007 \text{ (mw/cm}^2\text{)} = 0.081 \text{ (mw/cm}^2\text{)} < 1.0 \text{ (mw/cm}^2\text{)}$$

$$\text{WCDMA Band 5+WIFI(2.4G)} = 0.059 \text{ mw/cm}^2 + 0.007 \text{ (mw/cm}^2\text{)} = 0.066 \text{ (mw/cm}^2\text{)} < 0.551 \text{ (mw/cm}^2\text{)}$$

3. GSM+BT:

$$\text{GSM850+BT(2.4G)} = 0.417 \text{ mw/cm}^2 + 0.0005 \text{ (mw/cm}^2\text{)} = 0.4175 \text{ (mw/cm}^2\text{)} < 0.549 \text{ (mw/cm}^2\text{)}$$

$$\text{GSM1900+BT(2.4G)} = 0.261 \text{ mw/cm}^2 + 0.0005 \text{ (mw/cm}^2\text{)} = 0.2615 \text{ (mw/cm}^2\text{)} < 1.0 \text{ (mw/cm}^2\text{)}$$

4. WCDMA+BT:

$$\text{WCDMA Band 2+BT (2.4G)} = 0.074 \text{ mw/cm}^2 + 0.0005 \text{ (mw/cm}^2\text{)} = 0.0745 \text{ (mw/cm}^2\text{)} < 1.0 \text{ (mw/cm}^2\text{)}$$

$$\text{WCDMA Band 5+BT(2.4G)} = 0.059 \text{ mw/cm}^2 + 0.0005 \text{ (mw/cm}^2\text{)} = 0.0595 \text{ (mw/cm}^2\text{)} < 0.551 \text{ (mw/cm}^2\text{)}$$

NOTE: GSM and WCDMA share the same antenna, and cannot transmit simultaneously. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.

Result: Pass

1.5 Test Setup Photos

