

1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 General Information

Client Information

Applicant: DBJ Technologies (Zhuhai) Co., Ltd.
Address of applicant: First Floor, Block 1, Manufacture Center, No. 1 Software Road, Zhuhai, Guangdong, China

Manufacturer: DBJ Technologies (Zhuhai) Co., Ltd.
Address of manufacturer: First Floor, Block 1, Manufacture Center, No. 1 Software Road, Zhuhai, Guangdong, China

General Description of EUT:

Product Name: GPS Tracker
Trade Name: /
Model No.: ZJ700
Adding Model(s): /
FCC ID: 2AEIXZJ700
Rated Voltage: DC6-40V
Battery Capacity: /

Technical Characteristics of EUT:	
3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2, WCDMA Band 4, WCDMA Band 5
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz WCDMA Band 4: 1710-1755 MHz WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz WCDMA Band 4: 2110-2155 MHz WCDMA Band 5: 869~894MHz
RF Output Power:	WCDMA Band 2: 23.25dBm, WCDMA Band 4: 23.38 dBm WCDMA Band 5: 24.35dBm
Type of Modulation:	QPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 1.11dBi, WCDMA Band 4: 1.08dBi WCDMA Band 5: -0.21dBi
4G	
Support Networks:	FDD-LTE
Support Band:	FDD-LTE Band 2, 4, 17
Uplink Frequency:	FDD-LTE Band 2: Tx: 1850-1910MHz,

	FDD-LTE Band 4: Tx: 1710-1755MHz, FDD-LTE Band 17: Tx: 704-716MHz
Downlink Frequency:	FDD-LTE Band 2: Rx: 1930-1990MHz, FDD-LTE Band 4: Rx: 2110-2155MHz, FDD-LTE Band 17: Rx: 734-746MHz
RF Output Power:	FDD-LTE Band 2: 23.84dBm, FDD-LTE Band 4: 22.67dBm, FDD-LTE Band 17: 23.37dBm
Type of Modulation:	QPSK, 16QAM
Antenna Type:	Integral Antenna
Antenna Gain:	FDD-LTE Band 2: 1.11dBi, FDD-LTE Band 1: 0.08dBi, FDD-LTE Band 17: -2.13dBi,

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

WCDMA Band 2:

Maximum Tune-Up output power: 24.0 (dBm)

Maximum peak output power at antenna input terminal: 251.19 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1852.4(MHz)

Antenna gain: 1.11(dBi)

Directional gain (numeric gain): 1.29

The worst case is power density at prediction frequency at 20cm: 0.064 (mw/cm²)

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

WCDMA Band 4:

Maximum Tune-Up output power: 24.0 (dBm)

Maximum peak output power at antenna input terminal: 251.19 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1732.6(MHz)

Antenna gain: 1.08(dBi)

Directional gain (numeric gain): 1.28

The worst case is power density at prediction frequency at 20cm: 0.064 (mw/cm²)

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

WCDMA Band 5:

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: 826.4 (MHz)

Antenna gain: -0.21(dBi)

Directional gain (numeric gain): 0.95

The worst case is power density at prediction frequency at 20cm: 0.060 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 0.55 (mw/cm²)

FDD-LTE Band 2:

Maximum Tune-Up output power: 24.00 (dBm)

Maximum peak output power at antenna input terminal: 251.19 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1905(MHz)

Antenna gain: 1.11(dBi)

Directional gain (numeric gain): 1.29

The worst case is power density at prediction frequency at 20cm: 0.064 (mw/cm²)

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

FDD-LTE Band 4:

Maximum Tune-Up output power: 23.0 (dBm)

Maximum peak output power at antenna input terminal: 199.53 (mW)

Prediction distance: >20(cm)

Prediction frequency: 1747.5(MHz)

Antenna gain: 1.08(dBi)

Directional gain (numeric gain): 1.28

The worst case is power density at prediction frequency at 20cm: 0.051 (mw/cm²)

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

FDD-LTE Band 17:

Maximum Tune-Up output power: 24.0 (dBm)

Maximum peak output power at antenna input terminal: 251.19 (mW)

Prediction distance: >20(cm)

Prediction frequency: 706.5(MHz)

Antenna gain: -2.13(dBi)

Directional gain (numeric gain): 0.61

The worst case is power density at prediction frequency at 20cm: 0.030 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 0.47 (mw/cm²)

NOTE: WCDMA and LTE share the same antenna, and cannot transmit simultaneously.

Result: Pass

1.5 Test Setup Photos

