# 1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## 1.1 General Information

**Client Information**

| | |
|---|---|
| Applicant: | TCL OVERSEAS MARKETING LIMITED |
| Address of applicant: | 7/F BUILDING 22E 22 SCIENCE PARK EAST AVENUE, HONG KONG SCIENCE PARK, SHATIN NT, Hong Kong |
| Manufacturer: | TCL OVERSEAS MARKETING LIMITED |
| Address of manufacturer: | 7/F BUILDING 22E 22 SCIENCE PARK EAST AVENUE, HONG KONG SCIENCE PARK, SHATIN NT, Hong Kong |

**General Description of EUT:**

| | |
|---|---|
| Product Name: | Robot Vacuum Cleaner |
| Trade Name: | TCL |
| Model No.: | RV3524BM |
| Adding Model(s): | RV3520B |
| Rated Voltage: | AC Input:AC120V/60Hz<br>Charging Port:DC24V<br>Battery:DC14.4V |
| Power Adapter Model: | / |
| Software Version: | V1.0.0.7 |
| Hardware Version: | V1.0 |
| FCC ID: | 2AZVS-RV3520B |
| Equipment Type: | Mobile Device |

*Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model RV3524BM, but the circuit and the electronic construction do not change, declared by the manufacturer.*

**Technical Characteristics of EUT:**

**Wi-Fi**

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|---|---|
| Support Standards: | 802.11b, 802.11g, 802.11n |
| Frequency Range: | 2412-2462MHz for 802.11b/g/n(HT20) |
| RF Output Power: | 15.49dBm (Conducted) |
| Type of Modulation: | DBPSK,BPSK,DQPSK,QPSK,16QAM,64QAM |
| Quantity of Channels: | 11 for 802.11b/g/n(HT20) |
| Channel Separation: | 5MHz |
| Type of Antenna: | PCB Antenna |
| Antenna Gain: | 3dBi |

**Bluetooth**

| | |
|---|---|
| Bluetooth Version: | V4.2 (BLE mode) |
| Frequency Range: | 2402-2480MHz |
| RF Output Power: | 4.71dBm (Conducted) |
| Data Rate: | 1Mbps |
| Modulation: | GFSK |
| Quantity of Channels: | 40 |
| Channel Separation: | 2MHz |
| Type of Antenna: | PCB Antenna |
| Antenna Gain: | 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 equivalents power density

## 1.3 MPE Calculation Method

$S = (30*P*G) / (377*R^2)$
S = power density (in appropriate units, e.g., $mw/cm^2$)
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

For Wi-Fi
Maximum Tune-Up output power: 16.0 (dBm)
Maximum peak output power at antenna input terminal: 39.81 (mW)
Prediction distance: >20(cm)
Prediction frequency: 2462 (MHz)
Antenna gain: 3 (dBi)
Directional gain (numeric gain): 2.00
The worst case is power density at prediction frequency at 20cm: 0.0158 ($mw/cm^2$)
MPE limit for general population exposure at prediction frequency: 1 ($mw/cm^2$)

For Bluetooth
Maximum Tune-Up output power: 5.0 (dBm)
Maximum peak output power at antenna input terminal: 3.16 (mW)
Prediction distance: >20(cm)
Prediction frequency: 2480 (MHz)
Antenna gain: 3 (dBi)
Directional gain (numeric gain): 2.00
The worst case is power density at prediction frequency at 20cm: 0.0013($mw/cm^2$)
MPE limit for general population exposure at prediction frequency: 1 ($mw/cm^2$)

Mode for Simultaneous Multi-band Transmission
Wi-Fi+ Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0158/1+0.0013/1=0.0171<1

Result: Pass