# Prediction of MPE at a given distance

## 1. Description of Device

| | | |
|---|---|---|
| Applicant | : | Shanghai Huace Navigation Technology Ltd. |
| Address | : | 577 Songying Road, Qingpu District, 201706 Shanghai, China |
| EUT Description | : | Tablet |
| Model No. | : | ESD-2 |
| Trademark | : | EFIX |
| Radio Technology | : | Bluetooth EDR&BLE |
| Operation frequency | : | 2402-2480MHz |
| Modulation type | : | GFSK, π/4 DQPSK, 8DPSK for EDR<br>GFSK for BLE |
| Radio Technology | : | 2.4G WIFI |
| Operation frequency | : | 2412MHz-2462MHz for IEEE 802.11 b, g. n/HT20<br>2422MHz~2452MHz for IEEE802.11n/HT40 |
| Modulation type | : | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n :OFDM(64QAM, 16QAM, QPSK, BPSK) |
| Radio Technology | : | 5G WIFI |
| Operation Frequency | : | 802.11a/n(HT20)/ac(HT20): 5180~5240MHz, 5260-5320MHz, 5500-5700, 5745~5825MHz<br>802.11n(HT40)/ac(HT40): 5190~5230MHz, 5260-5320MHz, 5500-5700, 5755~5795MHz<br>802.11ac(HT80): 5210MHz, 5290MHz, 5775MHz, 5500-5700; |
| Modulation technology: | : | IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11ac: OFDM (64QAM, 16QAM, QPSK, BPSK) |
| Support Networks | : | GPRS, EGPRS, WCDMA |
| Support Bands | : | GSM850, PCS1900, WCDMA Band V, WCDMA Band IV, WCDMA Band II |
| TX Frequency | : | GSM850: 824.20MHz-848.80MHz<br>PCS1900: 1850.20MHz-1909.80MHz<br>WCDMA Band V: 826.40MHz -846.60MHz<br>WCDMA Band II: 1852.40MHz -1907.60MHz<br>WCDMA Band IV: 1710MHz -1755MHz |
| Modulation type | : | GSM/GPRS: GMSK<br>EGPRS: GMSK/8PSK<br>WCDMA Band II/IV/V: QPSK |
| Support Bands | : | LTE Band 2/4/5/7/12/13/17/41 |
| TX Frequency | : | LTE Band 2: 1850 ~ 1910 MHz<br>LTE Band 4: 1710 ~ 1755 MHz<br>LTE Band 5: 824 ~ 849 MHz<br>LTE Band 7: 2500 ~ 2570 MHz<br>LTE Band 12: 699MHz ~ 716MHz<br>LTE Band 13: 777MHz ~ 787MHz<br>LTE Band 41: 2496MHz ~ 2670MHz |
| Modulation type | : | QPSK, 16QAM |

## 2. Limits

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density ($mW/cm^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/Controlled Exposure | | | | |
| 0.3-3.0 | 614 | 1.63 | *100 | 6 |
| 3.0-30 | 1842/f | 4.89/f | $*900/f^2$ | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1,500 | | | f/300 | 6 |
| 1,500-100,000 | | | 5 | 6 |
| (B) Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3-1.34 | 614 | 1.63 | *100 | 30 |
| 1.34-30 | 824/f | 2.19/f | $*180/f^2$ | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1,500 | | | f/1500 | 30 |
| 1,500-100,000 | | | 1.0 | 30 |

## 3. Test Procedure

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

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

## 4. Test lab information

Shenzhen Alpha Product Testing Co., Ltd

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission

Registration Number: 293961

July 15, 2019 Certificated by IC

Registration Number: 12135A

CAB identifier: CN0085

## 5. Result

Worse case is as below:

| Mode | Frequency (MHz) | Prediction distance (cm) | RF output power | | MPE ($mW/cm^2$) | Limit ($mW/cm^2$) |
|---|---|---|---|---|---|---|
| | | | dBm | mW | | |
| EDR | 2441 | 40 | 8.059 | 6.3959 | 0.00072 | 1 |
| BLE | 2440 | 40 | 6.707 | 4.6849 | 0.00052 | 1 |
| 2.4G WIFI | 2422 | 40 | 15.028 | 31.8273 | 0.00356 | 1 |
| 5G WIFI B1 | 5210 | 40 | 15.065 | 32.0996 | 0.00237 | 1 |
| 5G WIFI B2 | 5290 | 40 | 14.84 | 30.4789 | 0.00225 | 1 |
| 5G WIFI B3 | 5670 | 40 | 14.177 | 26.1638 | 0.00193 | 1 |
| 5G WIFI B4 | 5785 | 40 | 12.434 | 17.5146 | 0.00129 | 1 |
| GMS 850 | 824.20 | 40 | 31.93 | 1559.5525 | 0.09455 | 0.5494 |
| PCS1900 | 1909.80 | 40 | 31.99 | 1581.2480 | 0.12902 | 1 |
| WCDMA B5 | 836.6 | 40 | 24.47 | 279.8981 | 0.01697 | 0.5577 |
| WCDMA B2 | 1907.6 | 40 | 24.95 | 312.6079 | 0.02771 | 1 |
| WCDMA B4 | 1740.0 | 40 | 24.77 | 299.9163 | 0.02580 | 1 |
| LET B2 | 1909.3 | 40 | 24.46 | 279.2544 | 0.02425 | 1 |
| LTE B4 | 1754.3 | 40 | 24.59 | 287.7398 | 0.01333 | 1 |
| LTE B5 | 837 | 40 | 24.45 | 278.6121 | 0.01636 | 0.558 |
| LTE B7 | 2502.5 | 40 | 24.48 | 280.5434 | 0.01121 | 1 |
| LTE B12 | 715.3 | 40 | 24.49 | 281.1901 | 0.01651 | 0.4713 |
| LTE B13 | 779.5 | 40 | 24.47 | 279.8981 | 0.01643 | 0.523 |
| LTE B41 | 2687.5 | 40 | 24.47 | 279.8981 | 0.01370 | 1 |

*Maximum Simultaneous transmission MPE Ratios for EDR.1+5G WIFI B1 +GSM850:*

| Max MPE ratio $_{BT}$/Limit | Max MPE ratio $_{5G\ WIFI}$/Limit | Max MPE ratio $_{2G}$/Limit | ∑MPE ratios | Limit | Result |
|---|---|---|---|---|---|
| 0.00072 | 0.00356 | 0.12902 | 0.1333 | 1 | PASS |

BT/2.4G WIFI Maximum Gain is 3.52dBi, 2.25(Numeric)

5G WIFI Maximum Gain is 1.71dBi, 1.48(Numeric)

GSM 850: Maximum Gain is 0.86dBi, 1.22(Numeric)

PCS1900: Maximum Gain is 2.15dBi, 1.64(Numeric)

WCDMA Band V: Maximum Gain is 0.86dBi, 1.22(Numeric)

WCDMA Band IV: Maximum Gain is 2.38dBi, 1.73(Numeric)

WCDMA Band II: Maximum Gain is 2.15dBi, 1.64(Numeric)

LTE Band 2: Maximum Gain is 2.42dBi, 1.67(Numeric)

LTE Band 4: Maximum Gain is -0.31dBi, 0.93(Numeric)

LTE Band 5: Maximum Gain is 0.72dBi, 1.18(Numeric)

LTE Band 7: Maximum Gain is -0.95dBi, 0.80(Numeric)

LTE Band 12: Maximum Gain is -0.95dBi, 0.80(Numeric)

LTE Band 13: Maximum Gain is 0.72dBi, 1.18(Numeric)

LTE Band 41: Maximum Gain is -0.07dBi, 0.98(Numeric)

Therefore this device complies with FCC's RF radiation exposure limits for general population without SAR evaluation.