

Prediction of MPE at a given distance

Applicant	: Shanghai EFIX Geomatics Co.,Ltd.
Address	: Room 1137, Area D, 11th Floor, Building 1, No. 158, Shuanglian Road, Qingpu District, Shanghai
EUT Description	: Tablet
Model No.	: ESD-1 Pro
Trademark	: 
Radio Technology	: Bluetooth EDR&BLE
Operation frequency	: 2402-2480MHz
Modulation type	: GFSK, $\pi/4$ DQPSK, 8DPSK for EDR GFSK for BLE
Radio Technology	: 2.4G WIFI
Operation frequency	: 2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20 2422MHz~2452MHz for IEEE802.11n/HT40 IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
Modulation type	: IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) 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 802.11n(HT40)/ac(HT40): 5190~5230MHz, 5260-5320MHz, 5500-5700, 5755~5795MHz 802.11ac(HT80): 5210MHz, 5290MHz, 5775MHz, 5500-5700;
Modulation technology:	: IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 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 GSM850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz
TX Frequency	: WCDMA Band V: 826.40MHz -846.60MHz WCDMA Band II: 1852.40MHz -1907.60MHz WCDMA Band IV: 1710MHz -1755MHz GSM/GPRS: GMSK
Modulation type	: EGPRS: GMSK/8PSK WCDMA Band II/IV/V: QPSK
Support Bands	: LTE Band 2/4/5/7/12/13/17/41 LTE Band 2: 1850 ~ 1910 MHz LTE Band 4: 1710 ~ 1755 MHz LTE Band 5: 824 ~ 849 MHz
TX Frequency	: LTE Band 7: 2500 ~ 2570 MHz LTE Band 12: 699MHz ~ 716MHz LTE Band 13: 777MHz ~ 787MHz LTE Band 41: 2496MHz ~ 2670MHz
Modulation type	: QPSK, 16QAM

1. 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

2. 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

3. 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

4. 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	2402	40	7.68	5.8614	0.00044	1
BLE	2440	40	6.763	4.7457	0.00035	1
2.4G WIFI	2437	40	14.717	29.6278	0.00220	1
5G WIFI B1	5230	40	14.331	27.1082	0.00228	1
5G WIFI B2	5260	40	15.313	33.9860	0.00286	1
5G WIFI B3	5670	40	18.135	65.0879	0.00548	1
5G WIFI B4	5745	40	16.612	45.8353	0.00386	1
GMS 850	824.20	40	31.89	1545.2544	0.11212	0.5494
PCS1900	1909.80	40	31.63	1455.4591	0.04695	1
WCDMA B5	846.6	40	24.69	294.4422	0.02136	0.5577
WCDMA B2	1880	40	24.75	298.5383	0.00963	1
WCDMA B4	1752.6	40	24.52	283.1392	0.01293	1
LET B2	1880	40	24.45	278.6121	0.00899	1
LTE B4	1710.7	40	24.49	281.1901	0.01284	1
LTE B5	825.7	40	24.68	293.7650	0.02131	0.558
LTE B7	2502.5	40	24.32	270.3958	0.01957	1
LTE B12	707.5	40	24.43	277.3320	0.00961	0.4713
LTE B13	784.5	40	24.39	274.7894	0.01732	0.523
LTE B41	2498.5	40	24.42	276.6942	0.02003	1

Maximum Simultaneous transmission MPE Ratios for EDR+5G WIFI B3 +GSM850:

Max MPE ratio _{BT} /Limit	Max MPE ratio _{5G WIFI} /Limit	Max MPE ratio _{2G} /Limit	ΣMPE ratios	Limit	Result
0.00044	0.00548	0.11212	0.11804	1	PASS

BT/2.4G WIFI Maximum Gain is 1.75dBi, 1.5(Numeric)

5G WIFI Maximum Gain is 2.29dBi, 1.69(Numeric)

GSM 850: Maximum Gain is 1.64dBi, 1.46(Numeric)

PCS1900: Maximum Gain is -1.88dBi, 0.65(Numeric)

WCDMA Band V: Maximum Gain is 1.64dBi, 1.46(Numeric)

WCDMA Band IV: Maximum Gain is -1.88dBi, 0.65(Numeric)

WCDMA Band II: Maximum Gain is 0.37dBi, 0.92(Numeric)

LTE Band 2: Maximum Gain is -1.88dBi, 0.65(Numeric)

LTE Band 4: Maximum Gain is -0.37dBi, 0.92(Numeric)

LTE Band 5: Maximum Gain is 1.64dBi, 1.46(Numeric)

LTE Band 7: Maximum Gain is -1.57dBi, 0.7(Numeric)

LTE Band 13: Maximum Gain is 1.03dBi, 1.27 (Numeric)

LTE Band 41: Maximum Gain is 1.6dBi, 1.46(Numeric)

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