

RF Exposure Compliance Requirement

Model no.: SEA240/48I-U-HY, SEA240/40I-U-6Y, SEA240/40I-U-14Y

1. Standard requirement

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

(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 ²)*	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 ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	F/1500	30
1500-100000	--	--	1.0	30

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

2. MPE Calculation Method

$$E(V/m) = (30 \cdot P \cdot G)^{0.5} / d \quad \text{Power Density: } Pd(W/m^2) = E^2 / 377$$

E=Electric Field (V/m)

P=Peak RF output Power (W)

G=EUT Antenna numeric gain (numeric)

d= Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = (30 \cdot P \cdot G) / (377 \cdot d^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

3. Calculated Result and Limit

13.56 RFID:

E=42.62dB μ V/m@3m(max. value provided by client), antenna gain = 0dBi

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
13.56	1	-52.58	0.00000552	0.0000000011	0.98	Complies

MPE ratio:

$$0.0000000011(mW/cm^2) / 0.98(mW/cm^2) = 0.00000000112$$

WIFI:

Peak Output Power = 23.72dBm(max.value declared by client), antenna gain = 3.74dBi

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2412-2462	2.37	24.00	251.19	0.1182	1	Complies

MPE ratio:

$$0.1182(mW/cm^2) / 1(mW/cm^2) = 0.1182$$

BLE:

Peak Output Power = 1.59dBm(max.value declared by client), antenna gain = 3.74dBi

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2402-2480	2.37	2.00	1.58	0.0007	1	Complies

MPE ratio:

$$0.0007(mW/cm^2) / 1(mW/cm^2) = 0.0007$$

BT:

Peak Output Power = 5.05dBm(max.value declared by client), antenna gain = 3.74dBi

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2402-2480	2.37	5.50	3.55	0.0017	1	Complies

MPE ratio:

$$0.0017 \text{ (mW/cm}^2\text{)}/1\text{(mW/cm}^2\text{)} = 0.0017$$

LTE:

GSM850:antenna gain = 2.29dBi ,GSM1900: antenna gain = 1.59dBi ,WCDMA B2: antenna gain = 1.59 dBi,WCDMA B4: antenna gain = 2 dBi, WCDMA B5: antenna gain = 2.29dBi,LTE B2: antenna gain = 1.59dBi,LTE B4: antenna gain = 2.00dBi
LTE B5: antenna gain = 2.29dBi,LTE B7: antenna gain = 3dBi,LTE B12: antenna gain = 3.26dBi
LTE B13: antenna gain = 4.45dBi,LTE B25: antenna gain = 1.59dBi,LTE B26(814-824): antenna gain = 2.53dBi
LTE B26(824-849): antenna gain = 2.53dBi,LTE B38: antenna gain = 2.06dBi,LTE B41: antenna gain = 3.00dBi

Operating Band	Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
GSM850	824.2-848.8	1.69	25.81	381.07	0.1284	0.5495	Complies
GSM1900	1850.2-1909.8	1.44	22.81	190.99	0.0548	1	Complies
WCDMA B2	1852.4-1907.6	1.44	25.00	316.23	0.0907	1	Complies
WCDMA B4	1712.4-1752.6	1.58	25.00	316.23	0.0997	1	Complies
WCDMA B5	826.4-846.6	1.69	25.00	316.23	0.1066	0.5509	Complies
LTE B2	1850.7-1909.3	1.44	25.00	316.23	0.0907	1	Complies
LTE B4	1710.7-1754.3	1.58	25.00	316.23	0.0997	1	Complies
LTE B5	824.7-848.3	1.69	25.00	316.23	0.1066	0.5498	Complies
LTE B7	2502.5-2567.5	2.00	25.00	316.23	0.1255	1	Complies
LTE B12	699.7-715.3	2.12	25.00	316.23	0.1333	0.4665	Complies
LTE B13	779.5-784.5	2.79	25.00	316.23	0.1753	0.5197	Complies
LTE B25	1850.7-1914.3	1.44	25.00	316.23	0.0907	1	Complies
LTE B26(814-824)	814.7-823.3	1.79	25.00	316.23	0.1126	0.5431	Complies
LTE B26(824-849)	824.7-848.3	1.79	25.00	316.23	0.1126	0.5498	Complies
LTE B38	2572.5-2617.5	1.61	25.00	316.23	0.1011	1	Complies
LTE B41	2498.5-2687.5	2.00	25.00	316.23	0.1255	1	

MPE ratio:

$$\text{GSM850: } 0.1284 \text{ (mW/cm}^2\text{)}/ 0.5495\text{(mW/cm}^2\text{)}=0.2337$$

$$\text{GSM1900: } 0.0548 \text{ (mW/cm}^2\text{)}/ 1\text{(mW/cm}^2\text{)}= 0.0548$$

$$\text{WCDMA B2: } 0.0907 \text{ (mW/cm}^2\text{)}/ 1\text{(mW/cm}^2\text{)}= 0.0907$$

$$\text{WCDMA B4: } 0.0997 \text{ (mW/cm}^2\text{)}/ 1\text{(mW/cm}^2\text{)}= 0.0997$$

WCDMA B5: $0.1066 \text{ (mW/cm}^2\text{)} / 0.5509 \text{ (mW/cm}^2\text{)} = 0.1935$
LTE B2: $0.0907 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.0907$
LTE B4: $0.0997 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.0997$
LTE B5: $0.1066 \text{ (mW/cm}^2\text{)} / 0.5498 \text{ (mW/cm}^2\text{)} = 0.1939$
LTE B7: $0.1255 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.1255$
LTE B12: $0.1333 \text{ (mW/cm}^2\text{)} / 0.4665 \text{ (mW/cm}^2\text{)} = 0.2857$
LTE B13: $0.1333 \text{ (mW/cm}^2\text{)} / 0.4665 \text{ (mW/cm}^2\text{)} = 0.2857$
LTE B25: $0.1753 \text{ (mW/cm}^2\text{)} / 0.5197 \text{ (mW/cm}^2\text{)} = 0.3373$
LTE B26(814-824): $0.1126 \text{ (mW/cm}^2\text{)} / 0.5431 \text{ (mW/cm}^2\text{)} = 0.2073$
LTE B26(824-849): $0.1753 \text{ (mW/cm}^2\text{)} / 0.5498 \text{ (mW/cm}^2\text{)} = 0.3188$
LTE B38: $0.1011 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.1011$
LTE B41: $0.1255 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.1255$

The sample support one Bluetooth& WIFI modular and one antenna, Not need consider simultaneous Transmission of Bluetooth& WIFI. The maximum MPE ratio of WIFI was selected as the evaluation.

Sum of the MPE ratio for all simultaneously transmitting antennas of NFC, WIFI and LTE:

RFID+WIFI+GSM850: $0.00000000112 + 0.1182 + 0.2337 = 0.35190000112 < 1$
RFID+WIFI+GSM1900: $0.00000000112 + 0.1182 + 0.0548 = 0.17300000112 < 1$
RFID+WIFI+WCDMA B2: $0.00000000112 + 0.1182 + 0.0907 = 0.20890000112 < 1$
RFID+WIFI+WCDMA B4: $0.00000000112 + 0.1182 + 0.0997 = 0.21790000112 < 1$
RFID+WIFI+WCDMA B5: $0.00000000112 + 0.1182 + 0.1935 = 0.31170000112 < 1$
RFID+WIFI+LTE B2: $0.00000000112 + 0.1182 + 0.0907 = 0.20890000112 < 1$
RFID+WIFI+LTE B4: $0.00000000112 + 0.1182 + 0.0997 = 0.21790000112 < 1$
RFID+WIFI+LTE B5: $0.00000000112 + 0.1182 + 0.1939 = 0.31210000112 < 1$
RFID+WIFI+LTE B7: $0.00000000112 + 0.1182 + 0.1255 = 0.24370000112 < 1$
RFID+WIFI+LTE B12: $0.00000000112 + 0.1182 + 0.2857 = 0.40390000112 < 1$
RFID+WIFI+LTE B13: $0.00000000112 + 0.1182 + 0.2857 = 0.40390000112 < 1$
RFID+WIFI+LTE B25: $0.00000000112 + 0.1182 + 0.3373 = 0.45550000112 < 1$
RFID+WIFI+LTE B26(814-824): $0.00000000112 + 0.1182 + 0.2073 = 0.32550000112 < 1$
RFID+WIFI+LTE B26(824-849): $0.00000000112 + 0.1182 + 0.3188 = 0.43700000112 < 1$
RFID+WIFI+LTE B38: $0.00000000112 + 0.1182 + 0.1011 = 0.21930000112 < 1$
RFID+WIFI+LTE B41: $0.00000000112 + 0.1182 + 0.1255 = 0.24370000112 < 1$

According to MPE test Exclusion condition in KDB 447498 (D01) General RF Exposure Guidance D01 v06, the MPE report is not required.

Test Location:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

All tests were performed at:

Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China