

RF Exposure evaluation

According to 447498 D04 Interim General RF Exposure Guidance v01

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B.2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

$$ERP/EIRP = P_T + G_T - L_C$$

ERP/EIRP is the equivalent (or effective) radiated power [in same units as P_T , typically dBW, dBm, or power spectral density (psd)], relative to either a dipole antenna (ERP) or an isotropic antenna (EIRP).

P_T is the transmitter output power, in dBW, dBm, or psd (power over a specified reference bandwidth).

G_T is the gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP).

L_C is the signal attenuation in the connecting cable between the transmitter and the antenna, in dB.

For simultaneous transmission exposure cases, calculation formula is:

$$\sum_{k=1}^c \frac{\text{Evaluated}_k}{\text{Exposure Limit}_k} \leq 1$$

Mode	Frequency (MHz)	Output power (dBm)	Output power (mw)	Ant gain (dBi)	EIRP (dBm)	EIRP (mw)	ERP (dBm)	ERP (mw)	Distance (cm)	P_{th} (mW)
BT-EDR	2402	5.71	3.72	3.00	8.71	7.43	6.56	4.53	20	3060
BT-BLE	2440	8.59	7.23	3.00	11.59	14.42	9.44	8.79	20	3060

2.4G-WiFi	2437	22.66	184.50	3.00	25.66	368.13	23.51	224.39	20	3060
5.1G-WiFi	5190	16.27	42.36	3.00	19.27	84.53	17.12	51.52	20	3060
5.8G-WiFi	5745	20.11	102.57	3.00	23.11	204.64	20.96	124.74	20	3060
GSM850	824.2	25.81	381.07	0.88	26.69	466.66	24.54	284.45	20	1681.37
GSM1900	1850.2	22.81	190.99	0.59	23.40	218.78	21.25	133.35	20	3060
WCDMA B2	1852.4	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
WCDMA B4	1712.4	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
WCDMA B5	826.4	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1685.86
LTE B2	1850.7	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
LTE B4	1719.7	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
LTE B5	826.4	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1685.86
LTE B12	699.7	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1427.39
LTE B13	779.5	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1630.98
LTE B25	1850.7	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
LTE B26 (814~824)	814.7	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1661.99
LTE B26 (824~849)	824.7	25.00	316.23	0.88	25.88	387.26	23.73	236.05	20	1682.39
LTE B38	2572.5	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060
LTE B41	2498.5	25.00	316.23	0.59	25.59	362.24	23.44	220.80	20	3060

ERP= EIRP -2.15 dB

For simultaneous transmission is 2.4G-WiFi and GSM850 (worst case).

$$\sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} = 0.1203 + 0.2775 = 0.3978 < 1.$$

WORSE CASE

466.66mW<1681.37mW

368.13mW<3060mW

Remark:

Then SAR evaluation is not required