



July 19, 2018

TUV SUD BABT
Octagon House, Concorde Way
Segensworth Rd N, Fareham
PO15 5RL

Attention: Director of Certification

RE: Analysis of RF Exposure for Portable and Mobile use per KDB 447498 D01 Mobile Portable RF Exposure v06 and RSS-102 Issue 5 March 2015.

FCC ID: PKRNVWSK140

1. Limits

Limits for General Population/Uncontrolled Exposure (Title 47 Subpart J §2.1091 and KDB 447498 D01 referring to limits under §1.1310)

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Electric Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time (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 - 100,000	-	-	1.0	30

f = frequency in MHz

**Plane-wave equivalent power density*



Limits for Devices Used by the General Public (Uncontrolled Environment (RSS-102 Issue 5 March 2015))

Frequency Range (MHz)	Electric Field Strength (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003 - 10 ²¹	83	90	-	Instantaneous
0.1 - 10	-	0.73/f	-	6**
1.1 - 10	87/f ^{0.5}	-	-	6**
10 - 20	27.46	0.0728	2	6
20 - 48	-58.07/f ^{0.25}	0.1540/f ^{0.25}	8.944/f ^{0.5}	6
48 - 300	22.06	0.05852	1.291	6
300 - 6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	616000/f ^{1.2}
150000 - 300000	0.158f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/f ^{1.2}

f is frequency in MHz

*Based on nerve stimulation (NS)

** Based on specific absorption rate (SAR)

2. Mobile MPE Calculation Summary using a 20cm separation distance:

Mode	Output Power (dBm)*	Power Density (mW/cm ²)	Power Density (W/m ²)	FCC Limit (mW/cm ²)	ISED Limit (W/m ²)
LTE Band 2	26.06	0.0803027	0.803027	1	4.525796
LTE Band 4	27.64	0.1155394	1.155394	1	4.279166
LTE Band 13	23.01	0.039786	0.39786	0.52	2.47972
2.4G WiFi	20.53	0.0409006	0.409006	1	5.366018

- The output power for each cellular band refers to report No.: ER/2016/30071, issued by SGS Taiwan Ltd.;
- The output power for 2.4G WiFi refers to report No.: SZEM180600552101, issued by SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch;



3. Co-Located Transmitters transmission table:

Transmitter type	Transmitter type that can transmit at the same time
LTE Band 2	2.4G WiFi
LTE Band 4	2.4G WiFi
LTE Band 13	2.4G WiFi
2.4G WiFi	LTE Band 2, or LTE Band 4 or LTE Band 13 and 2.4G BLE

4. Simultaneous Transmission MPE:

Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	IC Limit (W/m ²)	FCC MPE ratio (MPE/Limit)	ISED MPE ratio (MPE/Limit)
LTE Band 2	0.0803027	1	4.525796	0.0803027	0.1774333
2.4G WiFi	0.0409006	1	5.366018	0.0409006	0.0762215
Sum of the ratios (should be <1.0)				0.121203	0.253655

Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	IC Limit (W/m ²)	FCC MPE ratio (MPE/Limit)	ISED MPE ratio (MPE/Limit)
LTE Band 4	0.115534	1	4.279166	0.115534	0.2699919
2.4G WiFi	0.0409006	1	5.366018	0.0409006	0.0762215
Sum of the ratios (should be <1.0)				0.156435	0.346213

Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	IC Limit (W/m ²)	FCC MPE ratio (MPE/Limit)	ISED MPE ratio (MPE/Limit)
LTE Band 13	0.039786	0.52	2.47972	0.0765115	0.1604455
2.4G WiFi	0.0409006	1	5.366018	0.0409006	0.0762215
Sum of the ratios (should be <1.0)				0.117412	0.236667

5. Mobile MPE Calculation using a 20cm separation distance

Using Power Density formula:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to isotropic

R = distance to the center of radiation of the antenna



LTE Band 2:

Maximum peak output power at antenna input terminal:	26.06	(dBm)
Maximum peak output power at antenna input terminal:	403.65	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.0	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1752.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.525796	(W/m ²)
Power density at prediction frequency:	0.0803027	(mW/cm ²)
Power density at prediction frequency:	0.803027	(W/m ²)
FCC Margin of Compliance:	-10.95	(dB)
IC Margin of Compliance:	-7.51	(dB)

LTE Band 4:

Maximum peak output power at antenna input terminal:	27.64	(dBm)
Maximum peak output power at antenna input terminal:	580.76	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.0	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1732	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.279166	(W/m ²)
Power density at prediction frequency:	0.1155394	(mW/cm ²)
Power density at prediction frequency:	1.155394	(W/m ²)
FCC Margin of Compliance:	-9.37	(dB)
IC Margin of Compliance:	-5.69	(dB)



LTE Band 13:

Maximum peak output power at antenna input terminal:	23.01	(dBm)
Maximum peak output power at antenna input terminal:	199.99	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.0	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	779.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.52	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.47972	(W/m ²)
Power density at prediction frequency:	0.039786	(mW/cm ²)
Power density at prediction frequency:	0.39786	(W/m ²)
FCC Margin of Compliance:	-11.16	(dB)
IC Margin of Compliance:	-7.95	(dB)

2.4GHz WiFi:

Maximum peak output power at antenna input terminal:	20.53	(dBm)
Maximum peak output power at antenna input terminal:	112.98	(mW)
Antenna gain(typical):	2.6	(dBi)
Maximum antenna gain:	1.82	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2412	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.366018	(W/m ²)
Power density at prediction frequency:	0.0409006	(mW/cm ²)
Power density at prediction frequency:	0.409006	(W/m ²)
FCC Margin of Compliance:	-13.88	(dB)
IC Margin of Compliance:	-11.18	(dB)



America

2.4GHz BLE:

Maximum peak output power at antenna input terminal:	-1.14	(dBm)
Maximum peak output power at antenna input terminal:	0.77	(mW)
Antenna gain(typical):	2.5	(dBi)
Maximum antenna gain:	1.778	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2402	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.350805	(W/m ²)
Power density at prediction frequency:	0.0002721	(mW/cm ²)
Power density at prediction frequency:	0.002721	(W/m ²)
FCC Margin of Compliance:	-35.65	(dB)
IC Margin of Compliance:	-32.94	(dB)

Sincerely,

Xiaoying Zhang

Name

Authorized Signatory

Title: EMC/Wireless Test Engineer