



November 13, 2017

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 v05r02 and RSS-102 Issue 5 March 2015.

FCC ID: NU: YETQ34-45121325NU
CU: YETQ34-45121325CU

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:

Downlink (CU)					
Mode	Output Power (dBm)*	Power Density (mW/cm ²)	Power Density (W/m ²)	FCC Limit (mW/cm ²)	ISED Limit (W/m ²)
WCDMA Band 5	15.07	0.0063934	0.063934	0.58	2.676
LTE Band 12	16.73	0.0093698	0.093698	0.489	2.38
LTE Band 4	17.84	0.0191748	0.191748	1.00	4.913
LTE Band 13	13.67	0.0046316	0.046316	0.499	2.41
LTE Band 25	10.08	0.0032117	0.032117	1	4.612
2.4G BLE	8.06	0.0012727	0.012727	1	5.351

Uplink (NU)					
Mode	Output Power (dBm)*	Power Density (mW/cm ²)	Power Density (W/m ²)	FCC Limit (mW/cm ²)	ISED Limit (W/m ²)
WCDMA Band 5	17.34	0.0107828	0.107828	0.55	2.58
LTE Band 12	22.56	0.0358699	0.358699	0.468	2.307
LTE Band 4	22.98	0.0626225	0.626225	1	4.246
LTE Band 13	24.30	0.0535464	0.535464	0.52	2.48
LTE Band 25	21.82	0.0480541	0.480541	1	4.48
2.4G BLE	8.06	0.0012727	0.012727	1	5.351

*Since the IC limit is related to the frequency, so the Output Power of the lowest frequency was selected as the worst case.



3. Co-Located Transmitters transmission table:

Downlink	
Transmitter type	Transmitter type that can transmit at the same time
WCDMA B5	2.4G BLE
LTE B12	2.4G BLE
LTE B4	2.4G BLE
LTE B13	2.4G BLE
LTE B25	2.4G BLE
2.4G BLE	WCDMA B5 or LTE B12/B4/B13/B25

Uplink	
Transmitter type	Transmitter type that can transmit at the same time
WCDMA B5	2.4G BLE
LTE B12	2.4G BLE
LTE B4	2.4G BLE
LTE B13	2.4G BLE
LTE B25	2.4G BLE
2.4G BLE	WCDMA B5 or LTE B12/B4/B13/B25
WCDMA B5	2.4G BLE

4. Simultaneous Transmission MPE:

Downlink					
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	0.0191748	1	4.913	0.0191748	0.03903
2.4G BLE	0.0012727	1	5.351	0.0012727	0.002378
Sum of the ratios (should be <1.0)				0.02	0.041

Uplink					
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	0.0535464	0.52	2.48	0.1029738	0.215913
2.4G BLE	0.0012727	1	5.351	0.0012727	0.002378
Sum of the ratios (should be <1.0)				0.10	0.218



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

WCDMA Band 5 Downlink:

Maximum peak output power at antenna input terminal:	15.07	(dBm)
Maximum peak output power at antenna input terminal:	32.14	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	871.4	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.58	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.676	(W/m ²)
Power density at prediction frequency:	0.0063934	(mW/cm ²)
Power density at prediction frequency:	0.063934	(W/m ²)
FCC Margin of Compliance:	-19.58	(dB)
IC Margin of Compliance:	-16.22	(dB)

LTE Band 12 Downlink:

Maximum peak output power at antenna input terminal:	16.73	(dBm)
Maximum peak output power at antenna input terminal:	47.10	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	734	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.489	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.380	(W/m ²)
Power density at prediction frequency:	0.0093698	(mW/cm ²)
Power density at prediction frequency:	0.093698	(W/m ²)
FCC Margin of Compliance:	-17.18	(dB)
IC Margin of Compliance:	-14.05	(dB)



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LTE Band 4 Downlink:

Maximum peak output power at antenna input terminal:	17.84	(dBm)
Maximum peak output power at antenna input terminal:	60.81	(mW)
Antenna gain(typical):	2.0	(dBi)
Maximum antenna gain:	1.585	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2120	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.913	(W/m ²)
Power density at prediction frequency:	0.0191748	(mW/cm ²)
Power density at prediction frequency:	0.191748	(W/m ²)
FCC Margin of Compliance:	-17.17	(dB)
IC Margin of Compliance:	-14.09	(dB)

LTE Band 13 Downlink:

Maximum peak output power at antenna input terminal:	13.67	(dBm)
Maximum peak output power at antenna input terminal:	23.28	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	748.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.499	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.412	(W/m ²)
Power density at prediction frequency:	0.0046316	(mW/cm ²)
Power density at prediction frequency:	0.046316	(W/m ²)
FCC Margin of Compliance:	-20.32	(dB)
IC Margin of Compliance:	-17.17	(dB)



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LTE Band 25 Downlink:

Maximum peak output power at antenna input terminal:	10.08	(dBm)
Maximum peak output power at antenna input terminal:	10.19	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.585	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1932.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.612	(W/m ²)
Power density at prediction frequency:	0.0032117	(mW/cm ²)
Power density at prediction frequency:	0.032117	(W/m ²)
FCC Margin of Compliance:	-24.93	(dB)
IC Margin of Compliance:	-21.57	(dB)

WCDMA Band 5 Uplink:

Maximum peak output power at antenna input terminal:	17.34	(dBm)
Maximum peak output power at antenna input terminal:	54.20	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	826.4	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.55	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.58	(W/m ²)
Power density at prediction frequency:	0.0107828	(mW/cm ²)
Power density at prediction frequency:	0.107828	(W/m ²)
FCC Margin of Compliance:	-17.08	(dB)
IC Margin of Compliance:	-13.79	(dB)



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LTE Band 12 Uplink:

Maximum peak output power at antenna input terminal:	22.56	(dBm)
Maximum peak output power at antenna input terminal:	180.30	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	701.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.468	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.307	(W/m ²)
Power density at prediction frequency:	0.0358699	(mW/cm ²)
Power density at prediction frequency:	0.358699	(W/m ²)
FCC Margin of Compliance:	-11.16	(dB)
IC Margin of Compliance:	-8.08	(dB)

LTE Band 4 Uplink:

Maximum peak output power at antenna input terminal:	22.98	(dBm)
Maximum peak output power at antenna input terminal:	198.61	(mW)
Antenna gain(typical):	2.0	(dBi)
Maximum antenna gain:	1.585	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1712.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.246	(W/m ²)
Power density at prediction frequency:	0.0626225	(mW/cm ²)
Power density at prediction frequency:	0.626225	(W/m ²)
FCC Margin of Compliance:	-12.03	(dB)
IC Margin of Compliance:	-8.31	(dB)



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LTE Band 13 Uplink:

Maximum peak output power at antenna input terminal:	24.30	(dBm)
Maximum peak output power at antenna input terminal:	269.15	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(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:	2.48	(W/m ²)
Power density at prediction frequency:	0.0535464	(mW/cm ²)
Power density at prediction frequency:	0.535464	(W/m ²)
FCC Margin of Compliance:	-9.87	(dB)
IC Margin of Compliance:	-6.66	(dB)

LTE Band 25 Uplink:

Maximum peak output power at antenna input terminal:	21.82	(dBm)
Maximum peak output power at antenna input terminal:	152.41	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.585	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1852.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.48	(W/m ²)
Power density at prediction frequency:	0.0480541	(mW/cm ²)
Power density at prediction frequency:	0.480541	(W/m ²)
FCC Margin of Compliance:	-13.18	(dB)
IC Margin of Compliance:	-9.70	(dB)



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2.4GHz BLE:

Maximum peak output power at antenna input terminal:	8.06	(dBm)
Maximum peak output power at antenna input terminal:	6.40	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1	(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:	1.00	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.351	(W/m ²)
Power density at prediction frequency:	0.0012727	(mW/cm ²)
Power density at prediction frequency:	0.012727	(W/m ²)
FCC Margin of Compliance:	-28.95	(dB)
IC Margin of Compliance:	-26.24	(dB)

Sincerely,

Xiaoying Zhang

Name

Authorized Signatory

Title: EMC/Wireless Test Engineer