



June 01, 2016

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Octagon House, Concorde Way
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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: 2ABLPAT2220

IC: 20546-AT2220

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	-	6**
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 44cm separation distance per FCC 2.1091::

Mode (Worst Case)	Output Power (dBm)	Power Density (mW/cm ²)
802.11b	19.38	0.0019
802.11g	15.32	0.0007
Bluetooth	7.25	0.0001
Satellite (L-Band)	29.92	0.1803

3. Mobile MPE Calculation Summary using a 44cm separation distance per RSS-102 Issue 5:

Mode (Worst Case)	Output Power (dBm)	Power Density (W/cm ²)
802.11b	19.38	0.019
802.11g	15.32	0.007
Bluetooth	7.25	0.001
Satellite (L-Band)	29.92	1.803

4. Co-Located Transmitters transmission table:

Transmitter type	Transmitter type that can transmit at the same time
WiFi 802.11 b/g	Satellite (L-Band) / Bluetooth
Bluetooth	WiFi / Satellite (L-Band)
Satellite	WiFi / Bluetooth



5. Simultaneous Transmission MPE:

Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
WiFi (802.11b)	0.0019	1.0000	0.0019
Bluetooth	0.0001	1.0000	0.0001
Satellite (L-Band)	0.1803	1.0000	0.1803
Sum of the ratios (should be <1.0)			0.1823

Transmitter type	MPE (W/m ²)	ISED Limit (W/m ²)	Margin (dB)
WiFi (802.11b)	0.019	5.442	-24.68
Bluetooth	0.001	5.409	-36.70
Satellite (L-Band)	1.803	4.099	-3.57
Sum of MPE (Should be <min. limit)	1.823	4.099	-2.276

6. Mobile MPE Calculation using a 44cm separation distance (802.11b):

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

Measured Field Strength --Radiated:	19.38	(dBuV/m)
Maximum peak output power --Radiated:	86.70	(mW)
Antenna gain(typical):	-2.84	(dBi)
Maximum antenna gain:	0.520	(numeric)
Prediction distance:	44	(cm)
Prediction frequency:	2462	(mW/cm ²)
FCC Limit at prediction frequency:	1.0	(mW/cm ²)
ISED Limit at prediction frequency:	5.442	W/ m ²
Power density at prediction frequency:	0.0019	(mW/cm ²)
Power density at prediction frequency:	0.019	(W/m ²)
FCC Margin of Compliance:	-27.32	(dB)
ISED Margin of Compliance:	-24.68	(dB)



7. Mobile MPE Calculation using a 44cm separation distance (802.11g):

Maximum peak output power at antenna input terminal:	15.32	(dBm)
Maximum peak output power at antenna input terminal:	34.04	(mW)
Antenna gain(typical):	-2.98	(dBi)
Maximum antenna gain:	0.504	(numeric)
Prediction distance:	44	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2412	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.366	(W/m ²)
Power density at prediction frequency:	0.0007	(mW/cm ²)
Power density at prediction frequency:	0.007	(W/m ²)
FCC Margin of Compliance:	-31.52	(dB)
ISED Margin of Compliance:	-28.82	(dB)

8. Mobile MPE Calculation using a 44cm separation distance (Bluetooth):

Maximum peak output power at antenna input terminal:	7.25	(dBm)
Maximum peak output power at antenna input terminal:	5.31	(mW)
Antenna gain(typical):	-2.76	(dBi)
Maximum antenna gain:	0.530	(numeric)
Prediction distance:	44	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2440	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.409	(mW/cm ²)
FCC Power density at prediction frequency:	0.0001	(mW/cm ²)
ISED Power density at prediction frequency:	0.001	(W/m ²)
FCC Margin of Compliance:	-39.37	(dB)
ISED Margin of Compliance:	-36.70	(dB)




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9. Mobile MPE Calculation using a 44cm separation distance (Satellite L-Band):

Maximum peak output power at antenna input terminal:	29.92	(dBm)
Maximum peak output power at antenna input terminal:	981.75	(mW)
Antenna gain(typical):	6.5	(dBi)
Maximum antenna gain:	4.467	(numeric)
Prediction distance:	44	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1626.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency	4.099	(W/m ²)
Power density at prediction frequency:	0.1803	(mW/cm ²)
Power density at prediction frequency:	1.803	(W/m ²)
FCC Margin of Compliance:	-7.44	(dB)
ISED Margin of Compliance:	-3.57	

Sincerely,



Alex Chang

Name

Authorized Signatory

Title: EMC/Wireless Test Engineer