



March 28, 2016

TUV SUD BABT
Octagon House, Concorde Way
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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: PKRNVWSA1100V
IC Number: 3229A-SA1100V

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*



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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 20cm separation distance:

Mode (Worst Case)	Output Power	Power Density (mW/cm ²)
Z-Wave	0.69 watt	0.13677
802.11n	0.44 watt	0.20125
CDMA2000	0.22 watt	0.05392

3. Co-Located Transmitters transmission table:

Transmitter type	Transmitter type that can transmit at the same time		
Z-Wave	802.11	3G	-
802.11	Z-Wave	3G	-
3G	Z-Wave	802.11	-

4. Simultaneous Transmission MPE:

Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
Z-Wave	0.00013677	0.6056	0.00022584
802.11	0.20125	1.0000	0.20125
3G	0.05392	0.5498	0.09807
Sum of the ratios (should be <1.0)			0.29954



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Transmitter type	MPE (W/m ²)	ISED Limit (W/m ²)	Margin (dB)
Z-Wave	0.0013677	2.75	-3.04
802.11	2.0125	5.44	-4.32
3G	0.5392	2.577	-6.79
Sum of MPE (Should be <min. limit)	2.553	2.577	-0.024

5. Mobile MPE Calculation using a 20cm separation distance (Z-Wave):

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:	93.6	(dBuV/m)
Maximum peak output power --Radiated:	0.6872603	(mW)
Antenna gain(typical):	0.00	(dBi)
Maximum antenna gain:	1.00	(numeric)
Prediction distance:	20.00	(cm)
Prediction frequency:	908.40	(mW/cm ²)
FCC Limit at prediction frequency:	0.6	(mW/cm ²)
ISED Limit at prediction frequency	2.75	W/ m ²
Power density at prediction frequency:	0.00013672609	(mW/cm ²)
Power density at prediction frequency:	0.0013672609	(W/m ²)
FCC Margin of Compliance:	-36.42	(dB)
ISED Margin of Compliance:	-33.04	(dB)



6. Mobile MPE Calculation using a 20cm separation distance (802.11n):

Maximum peak output power at antenna input terminal:	26.43	(dBm)
Maximum peak output power at antenna input terminal:	439.54	(mW)
Antenna gain(typical):	3.62	(dBi)
Maximum antenna gain:	2.301	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2437	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	5.44	(W/m ²)
Power density at prediction frequency:	0.20125	(mW/cm ²)
Power density at prediction frequency:	2.012	(W/m ²)
FCC Margin of Compliance:	-6.96	(dB)
ISED Margin of Compliance:	-4.32	(dB)

7. Mobile MPE Calculation using a 20cm separation distance (CDMA2000 Cellular):

Maximum peak output power at antenna input terminal:	23.33	(dBm)
Maximum peak output power at antenna input terminal:	215.28	(mW)
Antenna gain(typical):	1	(dBi)
Maximum antenna gain:	1.259	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	824.7	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.550	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	2.577	(mW/cm ²)
FCC Power density at prediction frequency:	0.05392	(mW/cm ²)
ISED Power density at prediction frequency:	0.539	(W/m ²)
FCC Margin of Compliance:	-10.08	(dB)
ISED Margin of Compliance:	-6.79	(dB)



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8. Mobile MPE Calculation using a 20cm separation distance (CDMA2000 PCS):

Maximum peak output power at antenna input terminal:	22.90	(dBm)
Maximum peak output power at antenna input terminal:	194.98	(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:	1851.25	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
ISED MPE limit for uncontrolled exposure at prediction frequency:	4.478	(W/m ²)
Power density at prediction frequency:	0.06148	(mW/cm ²)
Power density at prediction frequency:	0.615	(W/m ²)
FCC Margin of Compliance:	-12.11	(dB)
ISED Margin of Compliance:	-8.63	

Sincerely,

Ferdie S. Custodio

Name

Authorized Signatory

Title: Senior EMC/Wireless Test Engineer