Maximum Permissible Exposure (MPE)

Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

RSS 102 issue 5.

This is a Mobile device, the MPE is required.

FCC: According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
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
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

Maximum Permissible Exposure (MPE) Evaluation

FCC: 2.4GHz Wifi mode: 802.11 b has the worst case

Maximum Permissible Exposure (MPE) Evaluation: The worst case of Average power

Power measurement: refer to Part15.247 and RSS 247 report for details.

802.11b

Cable loss = 0	Output Power		Limit (dBm)
CH	Detector		
	PK (dBm)	AV (dBm)	
Low	18.51	14.86	30
Mid	17.77	14.58	
High	17.56	14.43	

Tune-Up power Tolerance: 1dB

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

	CH 1-11	
Tune-Up power at antenna input terminal:	14.00	(dBm)
Tune-Up power at antenna input terminal:	25.12	(mW)
Tune-Up power Tolerance:	1.00	dB
Duty cycle:	100.00	(%)
Maximum Pav :	31.62	(mW)
Antenna gain (typical):	4.90	(dBi)
Maximum antenna gain:	3.09	(numeric)
Prediction distance:	20.00	(cm)
MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm^2)
Power density at predication frequency at 20 (cm) distance	0.0195	(mW/cm^2)

Measurement Result:

The worst power density is 0.0195 mW/cm^2 which is less than 1 mW/cm^2.

FCC: 2.4GHz BT mode: EDR 3M has the worst case

Maximum Permissible Exposure (MPE) Evaluation: The worst case of Average power

Power measurement: refer to Part15.247 and RSS 247 report for details.

EDR 3M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	11.21	0.00	11.21	0.01321	0.125
Mid	11.65	0.00	11.65	0.01462	0.125
High	8.87	0.00	8.87	0.00771	0.125

Tune-Up power Tolerance: 1dB

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum output power at antenna input terminal:	11.65	(dBm)
Maximum output power at antenna input terminal:	14.62177174	(mW)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Maximum Pav :	18.40772001	(mW)
Antenna gain (typical):	4.9	(dBi)
Maximum antenna gain:	3.090295433	(numeric)
Prediction distance:	20	(cm)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.0113227	(mW/cm^2)

Measurement Result:

The worst power density is 0.0113227 mW/cm^2 which is less than 1 mW/cm^2.

Simultaneous transmission mode

WiFi 2.4GHz mode + BT 2.4GHz Mode:

Prediction frequency:	2.4	(GHz)
Power density at predication frequency at 20 (cm)	0.0129000	(mW/cm^2)

Prediction frequency:	2.4	(GHz)
Power density at predication frequency at 20 (cm)	0.0113227	(mW/cm^2)
2.4GHz + 2.4GHz Power density at predication frequency at 20 (cm) distance	0.0242227	(mW/cm^2)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)

The predicted power density level at 20 cm is 0.024227mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2.

Zigbee

Frequency Range(MHz)	2405-2480MHz
Modulation type	OQPSK
Channel Number	16
Antenna Designation:	Chip Antenna / 3.6dBi

Zigbee is certified as FCC part15.249 then it was not considered MPE issue.

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