

1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with § 2.1091 Radiofrequency radiation exposure evaluation: mobile devices of the FCC CFR 47 Rules, CFR 1.1310 (b) Radio frequency Radiation Exposure Requirement.

1.2. Special Accessories

Not available for this EUT intended for grant

1.3. Equipment Modifications

Not available for this EUT intended for grant.

1.4. Limitation

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

1.5. Exposure (MPE) Evaluation

The evaluation and calculation as deduces below presents only worst-case that produces highest value of the result:

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

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

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No.134, WuKung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803/新北市五股區新北產業園區五工路 134 號

t (886-2) 2299-3279

f (886-2) 2298-0488

www.tw.sgs.com

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Worst case Max Power of each band

Technology	Frequency (MHz)	Max Con-ducted Power (dBm)	Max Gain (dBi)	Duty Cycle	FCC Power Density @20cm (mW/cm ²)	FCC MPE Limit (mW/cm ²)
802.11b	2437	16.90	2.00	97.75	0.01510	1.000
802.11a	5180	19.63	3.00	87.79	0.03202	1.000
GSM 850	824.2	31.50	1.20	50	0.18532	0.549
GSM 1900	1850.2	31.50	0.50	50	0.15773	1.000
WCDMA II	1852.4	23.00	0.50	100	0.04456	1.000
WCDMA IV	1752.6	23.00	0.90	100	0.04886	1.000
WCDMA V	826.4	23.00	1.20	100	0.05235	0.551

The predicted power density level of all scenarios are below the uncontrolled exposure limit.

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2. Collocated MPE Analysis

The device may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:

- Each collocated radio transmitter has been certified by FCC for mobile application (that will be met since module will have its own FCC ID and host device will have its own FCC ID)
- At least 20 cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times (host installation should taking care of that)

The output power and antenna gain in a collocated configuration must not exceed the limits and configurations stipulated in the following table 1. The power density calculations for the individual transmitters per wireless technology at an exposure minimum separation distance of 20cm.

Exclusion of test condition:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0 .

$$\sum MPE\ ratio1 + MPE\ ratio2 + MPE\ ratio3 \leq 1.0$$

The spreadsheet as FCC deduces, and releases is employed to conduct the measurement:

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Worst case Max Power of each band

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802.11b	2437	16.90	2.00	97.75	0.01510	1.000
802.11a	5180	19.63	3.00	87.79	0.03202	1.000
GSM 850	824.2	31.50	1.20	50	0.18532	0.549
GSM 1900	1850.2	31.50	0.50	50	0.15773	1.000
WCDMA II	1852.4	23.00	0.50	100	0.04456	1.000
WCDMA IV	1752.6	23.00	0.90	100	0.04886	1.000
WCDMA V	826.4	23.00	1.20	100	0.05235	0.551

Evaluation is based on below combination that the device capable of transmitting simultaneously.

Scenario	1	2	3	4	5	6	7	8	9	10	11	12
802.11b	V	V	V	V	V	V						
802.11a							V	V	V	V	V	V
GSM 850	V	V	V				V	V	V			
GSM 1900				V	V	V				V	V	V
WCDMA II	V			V			V			V		
WCDMA IV		V			V			V			V	
WCDMA V			V			V			V			V

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Scenario 1:

802.11b + GSM 850 + WCDMA II

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA II (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA II / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.18532	0.549	0.33727	0.04456	1.000	0.04456	0.39693	0.549

Scenario 2:

802.11b+GSM 850+WCDMA IV

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA IV (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA IV / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.18532	0.549	0.33727	0.04886	1.000	0.04886	0.40123	0.549

Scenario 3:

802.11b+GSM 850+WCDMA V

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA V (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA V / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.18532	0.549	0.33727	0.05235	0.551	0.09503	0.44740	0.549

Scenario 4:

802.11b + GSM 1900 + WCDMA II

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA II (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA II / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.15773	1.000	0.15773	0.04456	1.000	0.04456	0.21740	1.000

Scenario 5:

802.11b + GSM 1900 + WCDMA IV

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA IV (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA IV / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.15773	1.000	0.15773	0.04886	1.000	0.04886	0.22169	1.000

Scenario 6:

802.11b + GSM 1900 + WCDMA V

802.11b (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11b / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA V (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA V / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.01510	1.000	0.01510	0.15773	1.000	0.15773	0.05235	0.551	0.09503	0.26786	0.551

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Scenario 7:

802.11a+GSM 850+WCDMA II

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA II (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA II / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.18532	0.549	0.33727	0.04456	1.000	0.04456	0.41385	0.549

Scenario 8:

802.11a+GSM 850+WCDMA IV

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA IV (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA IV / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.18532	0.549	0.33727	0.04886	1.000	0.04886	0.41815	1

Scenario 9:

802.11a+GSM 850+WCDMA V

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 850 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 850 / MPE limit	WCDMA V (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA V / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.18532	0.549	0.33727	0.05235	0.551	0.09503	0.46432	0.549

Scenario 10:

802.11a+GSM 1900+WCDMA II

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA II (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA II / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.15773	1.000	0.15773	0.04456	1.000	0.04456	0.23431	1.000

Scenario 11:

802.11a+GSM 1900+WCDMA IV

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA IV (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA IV / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.15773	1.000	0.15773	0.04886	1.000	0.04886	0.23861	1

Scenario 12:

802.11a+GSM 1900+WCDMA V

802.11a (mW/cm ²)	FCC MPE limit (mW/cm ²)	802.11a / MPE limit	GSM 1900 (mW/cm ²)	FCC MPE limit (mW/cm ²)	GSM 1900 / MPE limit	WCDMA V (mW/cm ²)	FCC MPE limit (mW/cm ²)	WCDMA V / MPE limit	Total (mW/cm ²)	FCC Limit (mW/cm ²)
0.03202	1.000	0.03202	0.15773	1.000	0.15773	0.05235	0.551	0.09503	0.28478	0.551

Measurement Result

The predicted power density level of all scenarios are below the uncontrolled exposure limit.

~ End of Report ~

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