

RF Exposure Evaluation

1.1. Applicable Standards

The RF Exposure Evaluation was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2.1091.

FCC CFR 47 Part 2.1091: Radiofrequency radiation exposure evaluation: mobile devices

1.2. Limits

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

MPE for the upper tier (people in controlled environments)

Frequency Range [MHz]	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100000	--	--	5	6
(B) 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
1500-100000	--	--	1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

For the DUT, the limits for the general public when an RF safety program is unavailable.

2. Calculations

2.1. RF Power Output

Frequency Band	Highest Averaged Power Output(dBm)	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)
GSM 850	34.00	24.97	3.52
GPRS 850 1TS	33.80	24.77	3.52
EGPRS 850 1TS	33.80	24.77	3.52
GSM 1900	31.20	22.17	3.57
GPRS 1900 1TS	31.10	22.07	3.57
EGPRS 1900 1TS	31.10	22.07	3.57
WCDMA Band 2	27.64	27.64	3.57
WCDMA Band 4	27.69	27.69	3.99
WCDMA Band 5	27.97	27.97	3.52
LTE Band 2	21.90	21.90	3.57
LTE Band 4	23.05	23.05	3.99
LTE Band 5	23.40	23.40	3.52
LTE Band 7	23.08	23.08	5.19
LTE Band 12	23.73	23.73	3.18
LTE Band 13	23.15	23.15	3.42
LTE Band 17	23.18	23.18	3.18
LTE Band 25	21.65	21.65	3.57
LTE Band 26	22.76	22.76	3.52
Bluetooth	12.44	12.44	5.84
WIFI 2.4	25.88	25.88	5.84
UNII 1	16.74	16.74	6.49
UNII 2A	16.62	16.62	6.49
UNII 2C	14.79	14.79	6.49
UNII 3	16.24	16.24	6.49

Notes:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

2) According to the conducted power as above, the measurements are performed with 1Txslots for 850MHz and 1900MHz.

2.2. Calculation Information

For conservative evaluation consideration, only maximum power of each frequency band based on the tighter limits respectively are used to calculate the boundary power density.

Based on the FCC KDB 447498 D01 and 47 CFR §2.1091, the DUT is evaluated as a mobile device.

$$S = \frac{PG}{4\pi d^2}$$

Where

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

2.3. Standalone Calculations

Frequency range	Limit(mW/cm ²)	Results(mW/cm ²)	Verdict
GSM 850	0.55	0.141	Pass
GPRS 850 1TS	0.55	0.134	Pass
EGPRS 850 1TS	0.55	0.134	Pass
GSM 1900	1.00	0.075	Pass
GPRS 1900 1TS	1.00	0.073	Pass
EGPRS 1900 1TS	1.00	0.073	Pass
WCDMA Band 2	1.00	0.263	Pass
WCDMA Band 4	1.00	0.293	Pass
WCDMA Band 5	0.55	0.280	Pass
LTE Band 2	1.00	0.070	Pass
LTE Band 4	1.00	0.112	Pass
LTE Band 5	0.55	0.098	Pass
LTE Band 7	1.00	0.134	Pass
LTE Band 12	0.47	0.098	Pass
LTE Band 13	0.50	0.090	Pass
LTE Band 17	0.47	0.086	Pass
LTE Band 25	1.00	0.066	Pass
LTE Band 26	0.54	0.084	Pass
Bluetooth	1.00	0.013	Pass
WIFI 2.4G	1.00	0.296	Pass
UNII 1	1.00	0.042	Pass
UNII 2A	1.00	0.041	Pass
UNII 2C	1.00	0.027	Pass

UNII 3	1.00	0.037	Pass
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2.4. Simultaneous Calculations

From (2.3. Results) We can get the combination of the maximum value of simultaneous transmission as WCDMA Band5 and WIFI 2.4G: $0.28/0.55+0.296/1.000=0.509+0.296=0.805$

Conclusion: max ratio 0.805 is less than 1,so complance RF exposure requirement.