



LCIE SUD EST
 Laboratoire de Moirans
 Z.I. Centr'Alp
 170, Rue de Chatagnon
 38430 MOIRANS – FRANCE

FCCID – host product: 2A2KQ–WSGW1
Modular approval contained: 2AJYU-8PYA004 and 2AF6B-RAK2247

RF Exposure Information

Prediction of MPE limit at a given distance

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

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

where: S = power density
 P = power input to the antenna
 G = power gain of the antenna in the direction of interest relative to an isotropic radiator
 R = distance to the center of radiation of the antenna

When all the antennas are at least 20cm away from the user's body (excluding hands and wrists during normal operation of the device), but individual antennas cannot be separated by more than 20cm from each other.

$$[Pd(1) / LPd(1)] + [Pd(2) / LPd(2)] + \dots + [Pd(n) / LPd(n)] < 1,$$

Where;
 Pd(n) = Power density of nth transmitter at 20cm
 LPd(n) = Power density limit for the nth transmitter

§ 1.1310 Radiofrequency radiation exposure limits.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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 Exposures				
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
1500–100,000 .....	.....	.....	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
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Following 447498 D01 General RF Exposure Guidance v06:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0.



LCIE SUD EST
Laboratoire de Moirans
Z.I. Centr'Alp
170, Rue de Chatagnon
38430 MOIRANS – FRANCE

LCIE

Calculations:

Power density – Modular certification:

Cellular module / FCCID: 2AJYU-8PYA004, extract form FCC certification file.

Calculation in worst case antenna and output power configuration:

Techn.	Frequency (MHz)	Output Power Cond. (dBm)	Output Power Cond. (W)	Max Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm²)	Power Density (W/m²)
GSM/GPRS850	836.6	24.97	0.31	-1	20	0.050	0.496
GSM/GPRS1900	1850.2	20.99	0.13	6	20	0.099	0.995
WCDMA B2	1880.0	23.00	0.20	10	20	0.397	3.969
WCDMA B4	1732.6	24.00	0.25	9	20	0.397	3.969
WCDMA B5	846.6	24.00	0.25	7	20	0.250	2.505
LTE B2	1850.0	24.00	0.25	10	20	0.500	4.997
LTE B4	1710.0	22.00	0.16	11	20	0.397	3.969
LTE B5	824.0	24.00	0.25	7	20	0.250	2.505
LTE B7	2535.0	24.00	0.25	10	20	0.500	4.997
LTE B12	707.5	24.00	0.25	6	20	0.199	1.989
LTE B13	782.0	24.00	0.25	6	20	0.199	1.989
LTE B25	1882.5	23.50	0.22	10	20	0.445	4.454
LTE B26	824.0	24.00	0.25	8	20	0.315	3.153
LTE B41	2505.0	24.00	0.25	9	20	0.397	3.969
LTE B66	1745.0	24.00	0.25	9	20	0.397	3.969

Lora Module / FCCID: 2AF6B-RAK2247, extract form FCC certification file.

Calculation in worst case antenna and output power configuration:

Techn.	Frequency (MHz)	Output Power Cond. (dBm)	Output Power Cond. (W)	Max Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm²)	Power Density (mW/cm²)
Lora	927.5	12.7	0.02	5.8	20	0.014	0.141



LCIE SUD EST
 Laboratoire de Moirans
 Z.I. Centr'Alp
 170, Rue de Chatagnon
 38430 MOIRANS – FRANCE

LCIE

Total Power Density calculated in all RF combinations:

Techn. 1	Frequency (MHz)	Power Density (mW/cm ²)	Limit Power Density (mW/cm ²)	Techn. 2	Frequency (MHz)	Power Density (mW/cm ²)	Limit Power Density (mW/cm ²)	TOTAL Power Density (mW/cm ²)	Result
GSM/GPRS850	836.6	0.050	0.558	Lora	927.5	0.014	0.618	0.112	PASS
GSM/GPRS1900	1850.2	0.099	1.000	Lora	927.5	0.014	0.618	0.122	PASS
WCDMA B2	1880.0	0.397	1.000	Lora	927.5	0.014	0.618	0.420	PASS
WCDMA B4	1732.6	0.397	1.000	Lora	927.5	0.014	0.618	0.420	PASS
WCDMA B5	846.6	0.250	0.564	Lora	927.5	0.014	0.618	0.467	PASS
LTE B2	1850.0	0.500	1.000	Lora	927.5	0.014	0.618	0.523	PASS
LTE B4	1710.0	0.397	1.000	Lora	927.5	0.014	0.618	0.420	PASS
LTE B5	824.0	0.250	0.549	Lora	927.5	0.014	0.618	0.479	PASS
LTE B7	2535.0	0.500	1.000	Lora	927.5	0.014	0.618	0.523	PASS
LTE B12	707.5	0.199	0.472	Lora	927.5	0.014	0.618	0.445	PASS
LTE B13	782.0	0.199	0.521	Lora	927.5	0.014	0.618	0.404	PASS
LTE B25	1882.5	0.445	1.000	Lora	927.5	0.014	0.618	0.468	PASS
LTE B26	824.0	0.315	0.549	Lora	927.5	0.014	0.618	0.597	PASS
LTE B41	2505.0	0.397	1.000	Lora	927.5	0.014	0.618	0.420	PASS
LTE B66	1745.0	0.397	1.000	Lora	927.5	0.014	0.618	0.420	PASS

Conclusion:

The device complies with FCC's RF radiation exposure limit for general population as a **mobile** device (**d>20cm**) under the collocation conditions described above.

LCIE
Anthony MERLIN
Technical Manager

January 5th, 2022