

Subject: RF exposure analysis for the equipment with FCC ID: **XKM-WPS-4G-V1**; IC: **8472A- WPS4GV1**

The device model: **Waspnote Plug & Sense! 4G US** (FCC ID: **XKM-WPS-4G-V1**; IC: **8472A- WPS4GV1**) is designed to be installed in and used in mobile exposure conditions.

The antennas used for this device must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

MPE exposure limits

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 5, section 4, titled “RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)”:

Frequency Range (MHz)	Power density (W/m ²)	Reference Period (minutes)
300 – 6000	$0.02619 f^{0.6834}$	6
6000 - 15000	10	6
15000 - 150000	10	$616000/ f^{1.2}$

Using the equation $S = \frac{PG}{4\pi R^2}$ to calculate the exposure to electromagnetic fields

where: S = power density (in appropriate units, e.g. mW/cm²)
P = power input to the antenna (in appropriate units, e.g., mW)
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 (appropriate units, e.g., cm)

Compliance with FCC and IC maximum permissive exposure limits is demonstrated based on the following calculations:

1. Standalone operations analysis

Frequency Band	Mode	Frequency Range (MHz)	Maximum conducted output power (per tune-up) (dBm)	Duty cycle (%)	Antenna gain (dBi)	EIRP (W)	FCC EIRP limit per §22.913, §24.232 and §27.50 (W)	IC EIRP limit per SRSP-503, SRSP-510 and SRSP-518 (W)	Evaluation distance for compliance with MPE limits (cm)	$S = \frac{PG}{4\pi R^2}$ (mW/cm ²)	MPE limit (FCC/IC worst case) (mW/cm ²)	MPE Ratio (S/MPE limit)
FDD 17	LTE Cat. 3 - 5 MHz BW	706,5-713,5	25,00	100%	-0,21	0,3013	4,92	5,00	20	0,05994	0,23200	0,25837
	LTE Cat. 3 - 10 MHz BW	709-711	25,00	100%	-0,21	0,3013	4,92	5,00	20	0,05994	0,23200	0,25837
GSM 850	GSM/GPRS/EDGE	824,2-848,2	33,50	25%	0,35	2,4266	11,48	11,50	20	0,12069	0,25800	0,46779
FDD V	UMTS/HSPA	826,4-846,6	25,00	100%	0,35	0,3428	11,48	11,50	20	0,06819	0,25800	0,26431
FDD 5	LTE Cat. 3 - 5 MHz BW	826,5-846,5	25,00	100%	0,35	0,3428	11,48	11,50	20	0,06819	0,25800	0,26431
	LTE Cat. 3 - 10 MHz BW	829-844	25,00	100%	0,35	0,3428	11,48	11,50	20	0,06819	0,25900	0,26329
FDD 4	LTE Cat. 3 - 5 MHz BW	1712,5-1752,5	25,00	100%	1,00	0,3981	1,00	1,00	20	0,07920	0,42500	0,18636
	LTE Cat. 3 - 10 MHz BW	1715,0-1750,0	25,00	100%	1,00	0,3981	1,00	1,00	20	0,07920	0,42500	0,18636
	LTE Cat. 3 - 20 MHz BW	1720,0-1745,0	25,00	100%	1,00	0,3981	1,00	1,00	20	0,07920	0,42600	0,18592
GSM 1900	GSM/GPRS/EDGE	1850,2-1909,8	30,50	25%	0,65	1,3032	2,00	2,00	20	0,06481	0,44800	0,14467
FDD II	UMTS/HSPA	1852,4-1907,6	25,00	100%	0,65	0,3673	2,00	2,00	20	0,07307	0,44800	0,16310
FDD 2	LTE Cat. 3 - 5 MHz BW	1852,5-1907,5	25,00	100%	0,65	0,3673	2,00	2,00	20	0,07307	0,44800	0,16310
	LTE Cat. 3 - 10 MHz BW	1855-1905	25,00	100%	0,65	0,3673	2,00	2,00	20	0,07307	0,44800	0,16310
	LTE Cat. 3 - 20 MHz BW	1860-1900	25,00	100%	0,65	0,3673	2,00	2,00	20	0,07307	0,44900	0,16274

Under all conditions the equipment complies with the FCC/IC MPE limits and the maximum MPE ratio obtained is 0,46779.

2. Co-location analysis

2.1. Co-location with other transmitter in mobile exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v06, 7.2:

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 .

As the maximum calculated MPE ratio for the device is **0,46779**, the product can be co-located with other antennas providing that the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density is $\leq 1.0 - 0,46779 = 0.53221$.

2.2. Co-location with other transmitter in mixed mobile and portable host platform exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v06, 7.2:

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

- The \sum of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + \sum of MPE ratios] is ≤ 1.0 .
- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the \sum of MPE ratios] is ≤ 1.0 .

As the maximum calculated MPE ratio for the device is **0,46779**, the equipment can be co-located with other transmitters in a mixed mobile and portable conditions providing that the exposure of the co-located transmitter complies with:

- The \sum of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + \sum of MPE ratios] is $\leq 1.0 - 0,46779 = 0.53221$
OR
- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the \sum of MPE ratios] is $\leq 1.0 - 0,46779 = 0.53221$

Signed on behalf of **Libelium Comunicaciones Distribuidas S.L.** on 22/09/2016

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