

MPE Evaluation

WiFi and Bluetooth Module, Model: WL18MODGI

IC: 25136 - WL18DBMOD; FCC ID:2ATLD- WL18DBMOD

EXHIBIT 1. EXPOSURE OF HUMANS TO RF FIELD [FCC SECTIONS 1.1310 & 2.1091, RSS-Gen, SECTION 3.2 & RSS-102]

1.1. Requirements

The criteria listed in the following tables shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR 1.1310(e) 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

RSS-102 Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

1.2. Method of Measurements

Calculation Method of Power Density:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where, P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

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MPE Evaluation for Co-location

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

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, according to calculated/estimated, numerically modeled, or measured field strengths or power density.

The following table addresses the co-location of the EUT with LTE Module at the minimum 22 cm evaluation separation distance required by the operating configurations and exposure conditions of the host device. A LTE module with operating conditions specified in the following table can be co-located with the EUT.

EUT Co-located with LTE Module											
Cellular Bands	Frequency Band (MHz)	Frequency	Max. Conducted Power (dBm)	Maximum Antenna Gain (dBi)	Peak/Average Max. EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm ²)	Power Density FCC Limit (mW/cm2)	FCC Power Density MPE Ratio	Power Density ISED Limit (mW/cm2)	ISED Power Density MPE Ratio
GSM	836.2-848.8	836.2	33.25	1	1330.36	22	0.219	0.557	0.392	0.260	0.841
GSM	1850.2-1909.8	1850.2	30.2	2.8	997.63	22	0.164	1.000	0.164	0.448	0.366
UMTS	1850-1907.6	1850	24.5	8.5	1995.26	22	0.328	1.000	0.328	0.448	0.733
UMTS	1710-1752.6	1710	24.5	5.5	1000.00	22	0.164	1.000	0.164	0.424	0.388
UMTS	824-846.6	824	24.5	6.7	1318.26	22	0.217	0.549	0.395	0.258	0.842
LTE	1850-1910	1850	24	9	1995.26	22	0.328	1.000	0.328	0.448	0.733
LTE	1710-1755	1710	24	6	1000.00	22	0.164	1.000	0.164	0.424	0.388
LTE	824-849	824	24	7.1	1288.25	22	0.212	0.549	0.386	0.258	0.822
LTE	2500-2570	2500	24	6	1000.00	22	0.164	1.000	0.164	0.550	0.299
LTE	704-716	704	24	6.7	1174.90	22	0.193	0.469	0.412	0.231	0.835
Bluetooth	2402-2480	2402	12.5	3.2	37.15	22	0.006	1.000	0.006	0.535	0.011
WLAN	2412-2462	2412	17.5	3.2	117.49	22	0.019	1.000	0.019	0.537	0.036
WLAN	5180-5825	5180	19.5	4.5	251.19	22	0.041	1.000	0.041	0.905	0.046
Worst Case Combination									0.478		0.935

LTE Module parameters-Green shaded cells
WL18MODGI module parameters-Blue shaded cells values extracted from MPE original report associated with the filings.