MAXIMUM PERMISSIBLE EXPOSURE

This Maximum Permissive Exposure (MPE) report demonstrates compliance for WL16A Module with FCC CFR 47 §1.1310 and 2.1091 for standalone and collocated simultaneous transmission in mobile exposure conditions. The MPE analysis is valid for transmitters operating within the parameters defined in Table A2 and A3 used for analysis.

Any collocated transmitter must have a valid FCC ID documenting equivalent or degraded RF Output Power with the collocated parameters calculated in this MPE analysis.

The mobile classification applies when 20 cm or more separation distance is maintained between the end user and WWAN, WLAN and Bluetooth transmission antennas.

Portable user conditions or additional collocated modules not allowed based on this RF exposure analysis require a Class II permissive change and updated MPE or SAR report.

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

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 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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

1. Stand Alone Transmitter Calculation

RESULTS

Table A1: WL16A (External Antenna)

Operating Mode	TX Freq Range (MHz)		Max Cond Average Power (dBm)	Max Ant Gain (dBi)	Max EIRP (dBm)	Power density @0.2m (mW/cm^2)	Power density @0.2m (W/m^2)	FCC MPE Limit (mW/cm^2)	IC MPE Limit (W/m^2)	FCC MPE Ratio	IC MPE Ratio
WLAN 2.4GHz SISO	2412	2472	15.00	5.00	20.00	0.020	0.199	1.000	5.366	**0.020**	**0.037**

Note 1: This is the upper limit of the tune-up tolerance.

Table A2: WL16A (Internal Antenna Aux)

Operating Mode	TX Freq Range (MHz)		Max Cond Average Power (dBm)	Max Ant Gain (dBi)	Max EIRP (dBm)	Power density @0.2m (mW/cm^2)	Power density @0.2m (W/m^2)	FCC MPE Limit (mW/cm^2)	IC MPE Limit (W/m^2)	FCC MPE Ratio	IC MPE Ratio
Bluetooth	2402	2480	8.00	1.25	9.25	0.002	0.017	1.000	5.351	**0.002**	**0.003**

Note 1: This is the upper limit of the tune-up tolerance.

Table A3: WW16A (Internal Antenna WWAN)

Operating Mode	TX Freq Range (MHz)		Max Cond Average Power (dBm)	Max Ant Gain (dBi)	Max EIRP (dBm)	Power density @0.2m (mW/cm^2)	Power density @0.2m (W/m^2)	FCC MPE Limit (mW/cm^2)	IC MPE Limit (W/m^2)	FCC MPE Ratio	IC MPE Ratio
WCDMA Band II LTE Band 2	1850	1910	24.00	6.00	30.00	0.199	1.989	1.000	4.476	0.199	0.444
WCDMA Band IV LTE Band 4	1710	1755	24.00	6.00	30.00	0.199	1.989	1.000	4.242	0.199	0.469
WCDMA Band V LTE Band 5	824	849	24.00	6.00	30.00	0.199	1.989	0.549	2.576	0.362	0.772
LTE Band 7	2500	2570	22.00	9.00	31.00	0.250	2.505	1.000	5.499	0.250	0.455
LTE Band 12	699	716	24.00	6.00	30.00	0.199	1.989	0.466	2.302	**0.427**	**0.864**
LTE Band 13	777	787	24.00	6.00	30.00	0.199	1.989	0.518	2.474	0.384	0.804
LTE Band 25	1850	1915	24.00	6.00	30.00	0.199	1.989	1.000	4.476	0.199	0.444
LTE Band 26	814	849	24.00	6.00	30.00	0.199	1.989	0.543	2.554	0.367	0.779
LTE Band 41	2496	2690	23.00	9.00	32.00	0.315	3.153	1.000	5.493	0.315	0.574

Note 1: This is the upper limit of the tune-up tolerance.

2. Collocated MPE Calculations

Table B1: WL16A (External Antenna) + WL16A (Internal Antenna Aux) + WW16A (Internal Antenna WWAN) for FCC

Operating Mode	WWAN MPE Ratio	WLAN MPE Ratio	Bluetooth MPE Ratio	Sum	Limit
WCDMA Band II LTE Band 2	0.199	0.020	0.002	0.221	1.000
WCDMA Band IV LTE Band 4	0.199	0.020	0.002	0.221	1.000
WCDMA Band V LTE Band 5	0.362	0.020	0.002	0.384	1.000
LTE Band 7	0.250	0.020	0.002	0.272	1.000
LTE Band 12	0.427	0.020	0.002	0.448	1.000
LTE Band 13	0.384	0.020	0.002	0.406	1.000
LTE Band 25	0.199	0.020	0.002	0.221	1.000
LTE Band 26	0.367	0.020	0.002	0.388	1.000
LTE Band 41	0.315	0.020	0.002	0.337	1.000

Table B2: WL16A (External Antenna) + WL16A (Internal Antenna Aux) + WW16A (Internal Antenna WWAN) for IC

Operating Mode	WWAN MPE Ratio	WLAN MPE Ratio	Bluetooth MPE Ratio	Sum	Limit
WCDMA Band II LTE Band 2	0.444	0.037	0.003	0.485	1.000
WCDMA Band IV LTE Band 4	0.469	0.037	0.003	0.509	1.000
WCDMA Band V LTE Band 5	0.772	0.037	0.003	0.813	1.000
LTE Band 7	0.455	0.037	0.003	0.496	1.000
LTE Band 12	0.864	0.037	0.003	0.905	1.000
LTE Band 13	0.804	0.037	0.003	0.844	1.000
LTE Band 25	0.444	0.037	0.003	0.485	1.000
LTE Band 26	0.779	0.037	0.003	0.819	1.000
LTE Band 41	0.574	0.037	0.003	0.614	1.000

As shown in the calculations above, when all devices are operational, the worst case combination is within the limit at a distance of 20cm from the device.