MAXIMUM PERMISSIBLE EXPOSURE
Model: WW12D
FCC ID: ACJ9TGWW12D

This Maximum Permissive Exposure (MPE) report demonstrates compliance for Module: WW12D with FCC CFR 47 §1.1310 and 2.1091 and IC Safety Code 6, Section 2.2.1 (a) for standalone and collocated simultaneous transmission in mobile exposure conditions.

The mobile classification applies when 20 cm or more separation distance is maintained between the end user and both WLAN Main Antenna and WWAN antenna.

Portable user conditions is evaluated the separate 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 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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
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.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

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.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of
S = 0.519 mW/cm^2 @ 700MHz
S = 0.549 mW/cm^2 @ 850MHz
S = 1.0 mW/cm^2 @ 1900MHz, 2.4GHz / 5GHz

From IC Safety Code 6, Section 2.2 Table 5 Column 4,
S = 5.19 mW/cm^2 @ 700MHz
S = 5.49 W/m^2 @ 850MHz
S = 10 W/m^2 @ 1900MHz, 2.4GHz, 5GHz

Simultaneous transmission operations

From 447498 23 D01 General RF Exposure Guidance v05 “Clause 7.2 Transmitters used in mobile exposure conditions for simultaneous transmission operations”, 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 [Σ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [Σ 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 [Σ of MPE ratios] is ≤ 1.0.

1. Stand Alone Operations

RESULTS

Table A1: WW12D

Technology	WW12E MPE Ratio	WL12A Aux 2.4GHz SAR Ratio	Sum of Ratios	Limit
CDMA 850MHz	0.065	0.058	0.123	1
CDMA 1900MHz	0.039	0.058	0.097	1
LTE Band 13	0.070	0.058	0.128	1

Remark: The above output power is the maximum powers from the tune-up procedure.

Table A2: WL12A (Main Antenna) (FCC ID: ACJ9TGWL12A)

Technology	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	FCC Limit (mW/cm^2)	MPE ratio
2412 - 2462	0.20	14.50	-1.28	0.004	1.000	0.004
5150 - 5250	0.20	15.00	-0.29	0.006	1.000	0.006
5250 - 5350	0.20	15.00	-0.29	0.006	1.000	0.006
5470 - 5725	0.20	15.00	-1.53	0.004	1.000	0.004
5725 - 5850	0.20	15.00	-2.35	0.004	1.000	0.004

Table A3: WL12A (Aux Antenna) (FCC ID: ACJ9TGWL12A)

Technology	Separation Distance (m)	Measured SAR or Estimated SAR (W/Kg)	(Measured SAR or Estimated SAR)/1.6
2412 - 2462	0	0.093	0.058
5150 - 5250	0	0.134	0.084
5250 - 5350	0	0.132	0.083
5470 - 5725	0	0.206	0.129
5725 - 5850	0	0.189	0.118
2402 - 2480	0.008	0.114	0.071

The 2.4GHz/5GHz WiFi SAR values are the measured SAR at Test Position “Rear 0mm” from UL CCS test report 12J14611-1 SAR report for FCC ID: ACJ9TGWL12A. The Bluetooth SAR value (2402-2480MHz) is the estimated SAR.

Table A4: WL12A (Main Antenna +Aux Antenna) (FCC ID: ACJ9TGWL12A)

Technology	Separation Distance (m)	Measured SAR (W/Kg)		Measured SAR/1.6	
		Main	Aux	Main	Aux
2412 - 2462	0	0.003	0.017	0.002	0.011
5150 - 5250	0	0.004	0.114	0.003	0.071
5250 - 5350	0	0.012	0.108	0.008	0.068
5470 - 5725	0	0.013	0.126	0.008	0.079
5725 - 5850	0	0.013	0.129	0.008	0.081

The 2.4GHz/5GHz WiFi SAR values are the measured SAR at Test Position “Rear 0mm” from UL CCS test report 12J14611-1 SAR report for FCC ID: ACJ9TGWL12A.

2. Simultaneous transmission operations

RESULTS

Table B1: WW12D +WL12A Main (802.11 2.4GHz) + WL12A Aux (802.11 2.4GHz)

Technology	WW12E MPE Ratio	WL12A Main 2.4GHz SAR Ratio	WL12A Aux 2.4GHz SAR Ratio	Sum of Ratios	Limit
CDMA 850MHz	0.065	0.002	0.011	0.078	1
CDMA 1900MHz	0.039	0.002	0.011	0.052	1
LTE Band 13	0.070	0.002	0.011	0.083	1

Table B2: WW12D +WL12A Main (802.11 5GHz) + WL12A Aux (802.11 5GHz)

Technology	WW12E MPE Ratio	WL12A Main SAR Ratio				WL12A Aux SAR Ratio				Sum of Ratios	Limit
		5.2GHz	5.3GHz	5.5GHz	5.8GHz	5.2GHz	5.3GHz	5.5GHz	5.8GHz		
CDMA 850MHz	0.065	0.003				0.071				0.139	1
	0.065		0.008				0.068			0.141	1
	0.065			0.008				0.079		0.152	1
	0.065				0.008				0.081	0.154	1
CDMA 1900MHz	0.039	0.003				0.071				0.113	1
	0.039		0.008				0.068			0.115	1
	0.039			0.008				0.079		0.126	1
	0.039				0.008				0.081	0.128	1
LTE Band 13	0.070	0.003				0.071				0.144	1
	0.070		0.008				0.068			0.146	1
	0.070			0.008				0.079		0.157	1
	0.070				0.008				0.081	0.159	1

Table B3: WW12D +WL12A Main (802.11 2.4GHz) + WL12A Aux (Bluetooth)

Technology	WW12E MPE Ratio	WL12A Main 2.4GHz MPE Ratio	WL12A Aux BT SAR Ratio	Sum of Ratios	Limit
CDMA 850MHz	0.065	0.004	0.071	0.14	1
CDMA 1900MHz	0.039	0.004	0.071	0.114	1
LTE Band 13	0.070	0.004	0.071	0.145	1

Table B4: WW12D + WL12A Main (802.11 5GHz) + WL12A Aux (Bluetooth)

Technology	WW12E MPE Ratio	WL12A Main SAR Ratio				WL12A Aux BT SAR Ratio	Sum of Ratios	Limit
		5.2GHz	5.3GHz	5.5GHz	5.8GHz			
CDMA 850MHz	0.065	0.006				0.071	0.142	1
	0.065		0.006			0.071	0.142	1
	0.065			0.004		0.071	0.14	1
	0.065				0.004	0.071	0.14	1
CDMA 1900MHz	0.039	0.006				0.071	0.116	1
	0.039		0.006			0.071	0.116	1
	0.039			0.004		0.071	0.114	1
	0.039				0.004	0.071	0.114	1
LTE Band 13	0.070	0.006				0.071	0.147	1
	0.070		0.006			0.071	0.147	1
	0.070			0.004		0.071	0.145	1
	0.070				0.004	0.071	0.145	1

Table B5: WW12D + WL12A Aux (802.11 2.4GHz)

Technology	WW12E MPE Ratio	WL12A Aux 2.4GHz SAR Ratio	Sum of Ratios	Limit
CDMA 850MHz	0.065	0.058	0.123	1
CDMA 1900MHz	0.039	0.058	0.097	1
LTE Band 13	0.070	0.058	0.128	1

As shown in the calculations above, when all devices are operational, the worst case combination is ≤ 1.0.