CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970 Fax: +82-31-624-9501
www.e-ctk.com

RF EXPOSURE EVALUATION

Applicant	**: Samsung Electronics Co Ltd**
Applicant Address	**: 19 Chapin Rd, Building D. Pine Brook, New Jersey, United States**
Kind of Product	**: Wi-Fi/BT Transceiver**
Equipment model name	**: WCC941M**
FCC ID	**: A3LWCC941M**

Standard Requirement

The following RF exposure procedures are applicable :

- FCC Rules
  Part 1.1310 Radiofrequency radiation exposure limits

  Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

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

f = frequency in MHz
** = Plane-wave equivalent power density*

MPE Calculations

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user. The MPE calculation for this exposure is shown below.

The peak radiated output power (EIRP) is calculated as follows:

EIRP = P + G	Where, P = Power input to the antenna (mW) G = Power gain of the antenna (dBi)

The numeric gain(G) of the antenna with a gain specified in dB is determined by:

$G = Log^{-1}$ (dB antenna gain / 10)

Power density at the specific separation:

$S = PG/(4R^2\pi)$	Where, S = Maximum power density (mW/cm^2) P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

Estimated safe separation:

$R = \sqrt{(PG / 4\pi)}$	Where, P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

RF Exposure Results

Mode	Measured Max Output Power (dBm)	G (dBi)	Power tolerance (dB)	P (dBm)	P (mW)	**Power Density (mW/cm^2)**	Limit (mW/cm^2)	R (cm)
BT	12.80	1.09	+2	14.80	30.20	**0.0077**	1.000	20
BLE	12.34	1.09	+2	14.34	27.16	**0.0069**		
WLAN 2.4 GHz	21.00	3.99 *	+2	23.00	199.53	**0.0995**		
WLAN 5 GHz	21.85	4.75 *	+2	23.85	242.66	**0.1441**		
WLAN 6 GHz	14.11	3.91 *	+2	16.11	40.83	**0.0200**		

* Note :
Per KDB 662911, the MIMO directional gain is calculated using the following formula, Where G_N is the gain of the nth antenna and N_{ANT}, the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

Simultaneous transmitter

Mode	MPE ratios **	Limit
BT	0.0077	-
BLE	0.0069	
WLAN 2.4 GHz	0.0995	
WLAN 5 GHz	**0.1441**	
WLAN 6 GHz	0.0200	
Combined	**0.2783**	1

** MPE ratios = MPE/MPE limit at each frequency