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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 : WCH931M

FCC ID : A3LWCH931M

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	1 842/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/1 500	<30
1,500-100,000			<u>1.0</u>	<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)
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The numeric gain(G) of the antenna with a gain specified in dB is determined by:

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

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 (20 cm = limit for MPE)
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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 (20 cm = limit for MPE)
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RF Exposure Results

Mode	Measured Max Output Power [dBm]	G [dBi]	Power Tolerance [dB]	P [dBm]	P [mW]	R [cm]	Power Density [mW/cm ²]	Limit [mW/cm ²]
BT	13.15	-3.30	+1.50	11.35	13.646	20.00	0.003	1.000
BLE	13.06	-3.30	+1.50	11.26	13.366		0.003	
WLAN 2.4 GHz	17.54	3.72	+1.50	22.76	188.799		0.038	
WLAN 5 GHz	16.94	3.51	+1.50	21.95	156.675		0.031	
WLAN 6 GHz	14.06**	-	+1.50	15.56	35.975		0.007	

* 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.

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

** Measured Max Output Power is EIRP.

Simultaneous Transmitter Results

Mode	P [mW]	Power Density [mW/cm ²]	Limit [mW/cm ²]
BT	13.646	-	-
BLE	13.366		
WLAN 2.4 GHz	188.799		
WLAN 5 GHz	156.675		
WLAN 6 GHz	35.975		
Combined	408.461	0.081	1.000

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