APPENDIX C - RF EXPOSURE EVALUATION

Applicable Standard

According to subpart §1.1310,15.247(i) systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	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;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Band (MHz)	Maximum Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
Uplink	698-716	21	6.6	1.60	20	0.08	0.465
	776-787	21	6.7	1.70	20	0.08	0.517
	824-849	22	7.1	1.70	20	0.11	0.549
	1710-1755	22	7.9	3.30	20	0.09	1.000
	1850-1915	23	8	2.60	20	0.14	1.000
Downlink	728-746	3	5.57	0.00	20	0.01	0.485
	746-757	1	5.79	0.00	20	0.01	0.497
	869-894	9	5.91	0.00	20	0.01	0.579
	2110-2155	9	7.61	0.00	20	0.01	1.000
	1930-1995	9	6.91	0.00	20	0.01	1.000
2.4G WLAN	2412-2462	20.50	3.26	0.00	20	0.047	1.000
Bluetooth	2402-2480	10.00	3.26	0.00	20	0.004	1.000
Note: the device contains a certified WLAN/Bluetooth module, FCC ID: 2AC7Z-ESPS3WROOM1.							

The WLAN/Bluetooth and Downlink are co-location:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{WLAN}/S_{limit\text{-}\ WLAN}+ S_{Downlink}/S_{limit\text{-}\ Downlink}$

$=0.047/1+0.01/0.485$

$=0.068$

< 1.0

Result: The device meet FCC MPE at 20 cm distance

******* END OF REPORT *******