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# RF Exposure Evaluation

| | |
|---|---|
| FCC ID | 2BDEFYV-19C |
| Applicant | YOUNGONE CORPORATION |
| Applicant Address | 25, Namdongseo-ro 362beon-gil, Namdong-gu, Incheon, Republic of Korea |
| Equipment under test | IoT-based ice carbonated all-in one unmanned beverage machine |
| Model name | YV-19C |
| Frequency Range | 802.11 b/g/n HT20 : 2 412 MHz ~ 2 472 MHz<br>802.11 n HT40 : 2 422 MHz ~ 2 462 MHz |
| Modulation technique | DSSS, CCK, OFDM |
| Number of channels | 802.11 b/g/n HT20 : 13 CH, 802.11 n HT40 : 9 CH |
| Antenna type | Chip Antenna(ANT 1, ANT 2) |
| Antenna gain | 1.5 dBi(Peak Gain) |
| Power source | 120 V~, 60 Hz |

# 1. Limit

According to FCC part 1.1310 :

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in § 1.1307(b)

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 (min) |
|---|---|---|---|---|
| (A) Limits for Occupational/Contolled 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

# 2. Friis Formula

Friis transmission formula : $P_d = (P_{out}*G) / (4*pi*r2)$

Where,

$P_d$ = power density in $mW/cm^2$

$P_{out}$ = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

$P_d$ the limit of MPE, 1 $mW/cm^2$. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

## 3. Result

| Test Mode | Channel | Channel Frequency (MHz) | Maximum Average Output Power (mW) | Antenna Gain (dBi) | Power Density at 20 cm ($mw/cm^2$) | Limit ($mW/cm^2$) |
|---|---|---|---|---|---|---|
| 802.11 b (1 Mbps) | 01 | 2 412 | 8.07 | 1.41 | 0.002 264 | 1 |
| | 07 | 2 442 | 9.79 | | 0.002 748 | |
| | 13 | 2 472 | 10.12 | | 0.002 838 | |
| 802.11 g (6 Mbps) | 01 | 2 412 | 10.33 | | 0.002 897 | |
| | 07 | 2 442 | 11.59 | | 0.003 250 | |
| | 13 | 2 472 | 11.40 | | 0.003 199 | |
| 802.11 n HT20 (MCS0) | 01 | 2 412 | 10.00 | | 0.002 805 | |
| | 07 | 2 442 | 4.92 | | 0.001 380 | |
| | 13 | 2 472 | 14.03 | | 0.003 935 | |
| 802.11 n HT20 (MCS0) | 03 | 2 422 | 9.98 | | 0.002 799 | |
| | 07 | 2 442 | 10.89 | | 0.003 055 | |
| | 11 | 2 462 | 13.52 | | 0.003 793 | |

* Antenna gain(numeric) : 1.41, $Gain_{(num)} = 10^{(Gain(dBi)/10)}$, $1.41 = 10^{(1.5/10)}$