

Client:	VusionGroup Inc.
Product Name/Model:	TopStock Gen 2.0 / TSR2-0120-A
FCC ID:	2ACQM-TSR2-0120-A
Reference	FCC KDB 447498 D04 v01

FCC RF Exposure

Where the Device Under Test (DUT) can be shown to meet the requirements for an exemption pursuant to FCC 47 CFR §1.1307(b)(3), an evaluation is not required with respect to the limits on human exposure to RF emissions provided in FCC 47 CFR §1.1310.

1. Determination of Exemption

As per 47 CFR §1.1307(b)(3), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device), a single RF source is exempt if:

- A. **1-mW Test Exemption:** The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);
- B. **SAR-Based Exemption:** The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} (mW) = \begin{cases} ERP(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20cm} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right) \text{ and } f \text{ is in GHz}$$

And

$$ERP_{20cm} (mW) = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the minimum separation distance (cm) in any direction from any part of the device antenna(s) or radiating structure(s) to the body of the device user.

- C. **MPE-Based Exemption:** Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 of § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (Watts)
0.3-1.34	$1,920 R^2$
1.34-30	$3,450 R^2/f^2$
30-300	$3.83 R^2$
300-1,500	$0.0128 R^2 f$
1,500-100,000	$19.2 R^2$

2. RF Exposure Evaluation

The DUT is a mobile device designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the RF source's radiating structure and the body of the user or nearby persons.

The EUT contains 2400 – 2483.5 MHz DTS (WIFI and BLE) transmitters, UNII-1, UNII-2A, UNII-2C, and UNII-3 WLAN transmitters.

ERP exemption threshold was calculated using the lowest operating frequency for each transmitter; the lower frequency resulted in a lower exemption limit.

2.1 DUT RF Output Power

Transmitter	Operation Band (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Max ERP (dBm)	Max ERP (W)	Minimum Separation Distance (cm)
BLE	2400 - 2483.5	10.31	-0.2	7.96	0.006	20
WLAN	2400 - 2483.5	13.25	-0.2	10.9	0.012	20
WLAN	5150 - 5250	17.44	2.8	18.09	0.064	20
WLAN	5250 - 5350	17.49	2.8	18.14	0.065	20
WLAN	5470 - 5725	14.17	2.8	14.82	0.030	20
WLAN	5725 - 5850	14.13	2.8	14.78	0.030	20

Note:

- ERP (dBm) = conducted power (dBm) + Antenna Gain (dBi) – 2.15
- ERP (W) = $10^{((ERP(dBm) - 30)/10)}$

2.2 MPE-Based Exemption

Evaluation Frequency (MHz)	Minimum Required Separation Distance ($\lambda/2\pi$) (mm)	Threshold ERP (W)	DUT Maximum ERP (W)
2402	1.9878	0.768	0.006
2412	1.9795	0.768	0.012
5180	0.9217	0.768	0.064
5260	0.9077	0.768	0.065
5500	0.8681	0.768	0.030
5745	0.8311	0.768	0.030

Note:

$$\lambda/2\pi = (3 \times 10^8 \text{ m/s}) / (2 * 3.14 * f \text{ (Hz)}) \text{ in meters}$$

The DUT separation distance is greater than the Minimum Required Separation Distance. And each transmitter operates below its applicable Threshold ERP Limit; thus, the RF Exposure Exemption requirement is met.

According to 47 CFR §1.1307(b)(3)(i)(B), this device complies with the RF exposure test exemption.

2.3 Simultaneous Transmission Evaluation

The transmitters on the EUT are located on different SoCs. The 2.4 GHz and 5 GHz WLANs are on one SoC (SoC1) and share the same antenna; the BLE is located on the second SoC (SoC2) and has its own antenna.

SoC1 could only either transmit 2.4 GHz or 5 GHz WLAN. Thus, the worst-case RF exposure is a combination of the highest ERP from each SoC. The highest ERP from SoC1 is 0.065 W and from SoC2 is 0.006 W.

Per 47 CFR Section 1307(b)(3)(ii)(B), the DUT qualify for simultaneous exemption if the transmitters meet the following requirement:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

$$\frac{0.065W}{0.768W} + \frac{0.006W}{0.768W} = 0.09 < 1$$

The DUT qualifies for simultaneous transmission exemption.

The DUT also contains a pre-certified BLE transmitted. The pre-certified BLE transmitter is more than 20 cm from the transmitters under certification. Thus, under FCC KDB 447498, the pre-certified BLE transmitter is no co-located with the transmitters in this application. Simultaneous transmission analysis is thus not required.