

<b>Client:</b>	Merry Electronics North America
<b>Product Name/Model:</b>	Guitar Speaker/Jamstack 2
<b>FCC ID:</b>	2BBQE-JAMSTACK2
<b>Reference</b>	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)(i), 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:

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

Where

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

And

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

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  $\lambda$  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

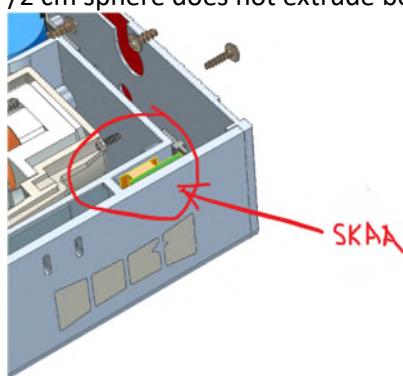
RF Source Frequency (MHz)	Threshold ERP (Watts)
0.3-1.34	1,920 R <sup>2</sup>
1.34-30	3,450 R <sup>2</sup> /f <sup>2</sup>
30-300	3.83 R <sup>2</sup>
300-1,500	0.0128 R <sup>2</sup> f
1,500-100,000	19.2 R <sup>2</sup>

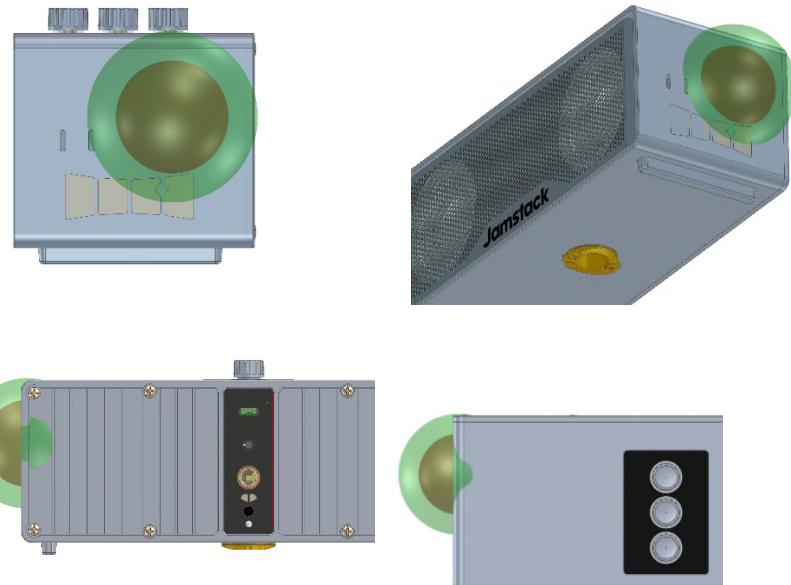
## 2. RF Exposure Evaluation

The DUT is a portable device designed to be used in other than fixed locations and generally used in such a way that the device's radiating structure is within 20 centimeters of the body of the user.

The DUT is intended for use on a guitar. During normal operation, the client stated that the minimum separation distance is 20 mm/2 cm to either hand or body.

Below are rendering showing the location of the Skaa antenna and the enclosure with scaled 20 mm/2 cm (in brown) and 30 mm/3 cm (in green) spheres centered around it. Other than the side, the 20 mm/2 cm sphere does not extrude beyond the enclosure.





Below is an example of a normal use case of the DUT:



Under normal use, a player does not put his hand on the enclosure of the DUT where the antenna is located. The player would not be able to play if the hand rest on the enclosure side containing the antenna.

## 2.1 DUT RF Output Power

The maximum peak conducted output power was 19.16 dBm. The DUT is a FHSS transmitter which uses 15 channels for active transmission. The FHSS algorithm cycles through the channels in 272.0 ms with 4.6 ms dwell time per hop (see Section 3.4 in Test report). Thus, in one cycle, the on time is  $15 * 4.6 = 69$  ms. Thus, the DUT has a source base duty cycle of  $69/272 = 25.4\%$ ; the DCCF is therefore, -11.9 dB. Alternatively, in 100 ms, the number channels used is 36% of the channels (6 channels); the on time in 100 ms is  $6 * 4.6 \text{ ms} = 27.6 \text{ ms}$  resulting with a source base DCCF of -11.2 dB. The worst-case average conducted power is  $19.16 - 11.2 = 8.0 \text{ dBm}$ .

The DUT uses an antenna with 3.2 dBi gain. The DUT operates from 2403.5 MHz to 2477.3 MHz

Evaluation Frequency (MHz)	Max Average Conducted Power (dBm)	Antenna Gain (dBi)	Max ERP (dBm)	Max ERP (mW)	Minimum Separation Distance (cm)
2477.3	8.0	3.2	9.1	8.1	2.0

Note:

1. EIRP (dBm) = Conducted power (dBm) + Antenna Gain (dBi)
2. ERP (dBm) = EIRP (dBm) – 2.15

## 2.2 SAR-Based Exemption

Threshold  $P_{th}$  (mW) for a 2.403 GHz to 2.477 GHz Transmitter with  $d = 2$  cm is given by:

$$P_{th} = 3060 (d/20)^{-\log_{10}\left(\frac{60}{3060 \sqrt{f \text{ (GHz)}}}\right)}$$

$$P_{th} = 3060 (2/20)^{-\log_{10}\left(\frac{60}{3060 \sqrt{2.477}}\right)} = 38.12 \text{ mW}$$

Maximum ERP of 8.1 mW is below the threshold of 38.12 mW.

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

## 2.3 Co-located Transmitter

The DUT integrates a Bluetooth/BLE module, FCC ID: 2ADHKB83SM1. The module's Bluetooth BR/EDR mode is used for receiving streaming audio using A2DP profile and the BLE mode is used to configure the DUT. The DUT does not support Bluetooth multi cast; this function was not implemented in the DUT's firmware.

Simultaneous transmission is not evaluated as the Bluetooth BR/EDR does not send an acknowledge packet when using A2DP profile; i.e. the module is used as a receiver. The use case for BLE mode is negligible in normal usage – users does not normally play guitar while using a BLE master device to configure DUT.