

Client:	SafelyYou
Product Name/Model:	Halo™ Wall Button / SYC-00046 Halo™ Pendant / SYC-00047
FCC ID:	2BCWO-SYR-0002
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 device designed to be used in other than fixed locations and generally used in such a way that the RF source's radiating structure is within 40 centimeters of the body of the user.

The Halo™ Wall Button is mobile and generally mounted on the wall where the end-user presses the button. The Halo™ Pendant is portable and worn around the neck where the end-user presses the button. The minimum separation distance from the radiating structure to any part of the body or extremity of a user is 10mm as stated by the manufacturer under normal operation. However, worst case measurement condition of 5mm separation distance is used for the exclusion analyses.

2.1 Transmission Duty Cycle

The SubGig transmitter has a maximum transmission duration of 0.2901 second in every 13.3 second. Which results in a duty cycle of 2.18% and a duty cycle correction factor (DCCF) of -16.61 dB. The duty cycle is source base and cannot be change by the user. See Halo RF Exposure by client in Appendix for additional details.

2.2 DUT RF Output Power

Transmitter protocol	Evaluation Frequency (MHz)	Max Conducted Power (dBm)	Antenna Gain (dBi)	DCCF (dB)	Avg ERP (dBm)	AVG ERP (mW)	Minimum Separation Distance (cm)
Lora DTS	903.00	21.10	1.52	-16.61	3.86	2.43	0.5
Lora FHSS	902.30	21.55	1.52	-16.61	4.31	2.70	0.5
BLE	2402.00	1.64	2.53	0	2.02	1.59	0.5

Note:

1. EIRP (dBm) = Sum of the conducted power (dBm) + Antenna Gain (dBi)
2. ERP (dBm) = EIRP (dBm) – 2.15
3. ERP (mW) = $10^{((ERP(dBm))/10)}$

2.3 SAR-Based Exemption

900MHz Transmitter Threshold:

$$P_{th} = 2040(0.903) \left((0.5/20)^{-\log_{10}\left(\frac{60}{2040(0.903)\sqrt{0.903}}\right)} \right) = 8.28 \text{ mW}$$

Maximum average ERP of 2.70 mW is below the threshold of 8.28 mW.

2.4GHz Transmitter Threshold:

$$P_{th} = 3060 (0.5/20)^{-\log_{10}\left(\frac{60}{3060 \sqrt{2.480}}\right)} = 2.72 \text{ mW}$$

Maximum ERP of 1.59 mW is below the threshold of 2.72 mW.

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

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

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

$$\frac{2.70 \text{ mW}}{8.28 \text{ mW}} + \frac{1.59 \text{ mW}}{2.72 \text{ mW}} = 0.91 < 1$$

The DUT qualifies for simultaneous transmission exemption.

3. Appendix – Transmission Duty Cycle Analysis

36 Clyde Street
San Francisco, CA 94107
info@safely-you.com
415.579.3630

Halo end-user device 915 MHz RF transmission details

A technical report on the hardware and software limitations as they are relevant for analyzing the RF exposure to end-users

Prepared by Ryan Schaub, Senior Embedded Systems Designer at SafelyYou, on 2026-05-01

Introduction

The end-user device in the Halo system is a wall-mounted button or a body-worn pendant with a button that can transmit emergency call messages to a radio-frequency receiver when pushed. These messages are transmitted on the 915 MHz “open” band in the USA. This document’s focus is the body-worn pendant, where there may be risk that the presence of a radio close to the body exceeds the limits of RF exposure as defined by the FCC.

The design and construction of the body-worn pendant (here forth referred to as “the device” or “the pendant” interchangeably) limit the frequency at which the device can transmit messages via the radio, the transmission power, the duration of transmissions, and the distance between the 915 MHz antenna and the body of the human wearing the device. This document explains these limitations.

Frequency of transmissions

The pendant is powered by a coin cell CR2450 battery, a power source that cannot deliver energy quickly enough to send a transmission over the 915 MHz radio on its own. To overcome this limitation, the device uses a super capacitor, which can store a lot of energy and also provide that energy quickly when needed. The device charges the super capacitor slowly from the battery, and then powers the radio via the super capacitor. This overcomes the limitation on “quick” power from the battery, but it introduces another limitation in that the device must wait to charge the super capacitor before it can transmit.

In practice, the pendant charges the super capacitor at a constant current of 16 mA. The time required to charge a capacitor at a constant current is given as:

$$i = C * (\text{change in voltage} / \text{time})$$

$$\text{time} = (C * \text{change in voltage}) / i$$

36 Clyde Street
San Francisco, CA 94107
info@safely-you.com
415.579.3630

The device charges the super capacitor to a specific voltage, 5.16 V, before a transmission starts. This ensures that there is enough energy for a transmission. The device also ensures that the super capacitor voltage never falls below 2.5 V, to account for limitations in the DC-DC conversion step between the super capacitor and the rest of the system. The super capacitor's nominal value is 100 mF, with a lower tolerance of -20 %. Our equation then becomes:

$$\text{time} = (80 \text{ mF} * (5.16 \text{ V} - 2.5 \text{ V})) / 16 \text{ mA}$$

This gives us a theoretical minimum charge time of 13.3 seconds. In practice, there are losses in the system that prolong this time, but for the purposes of this analysis, we can use 13.3 seconds.

Transmission power

The maximum possible transmission power in the 915 MHz band with the RF module used in the Halo end-user device is +22 dBm. This is a hardware limitation.

Transmission duration

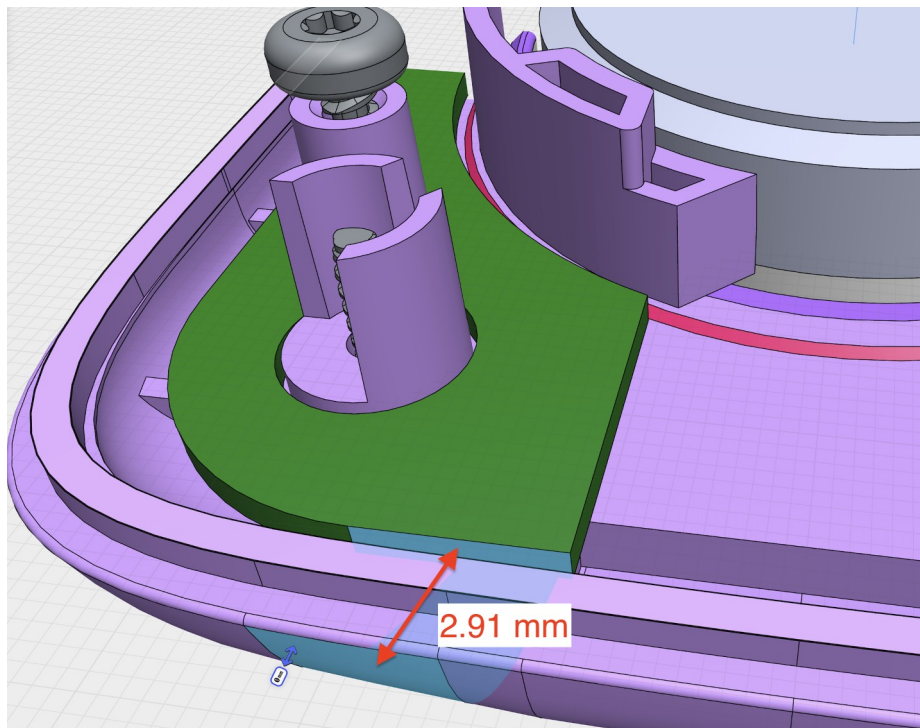
As discussed before, the end-user device employs a super capacitor in order to transmit RF messages over the 915 MHz band. A consequence of using such a component as a power source is that the system is unable to transmit continuously – rather it must do so in “bursts.” With that in mind, the Halo device intentionally sends only the absolute minimum amount of data possible. Depending on message type, the device sends only 13 to 36 bytes (including preambles and other overhead) as of this writing. This equates to a time-on-air for each transmission of 61.7 to 267.3 milliseconds.

In theory, there is enough energy stored in the super capacitor to transmit for longer (depending of course on transmission power), but doing so would reduce the battery life of the device. We have thus a strong incentive to keep the transmission time as short as possible. There are currently no plans to exceed the maximum time given above, but a 10 % margin would permit us to change our minds. Thus, let's say 290.1 milliseconds is the maximum.

36 Clyde Street
San Francisco, CA 94107
info@safely-you.com
415.579.3630

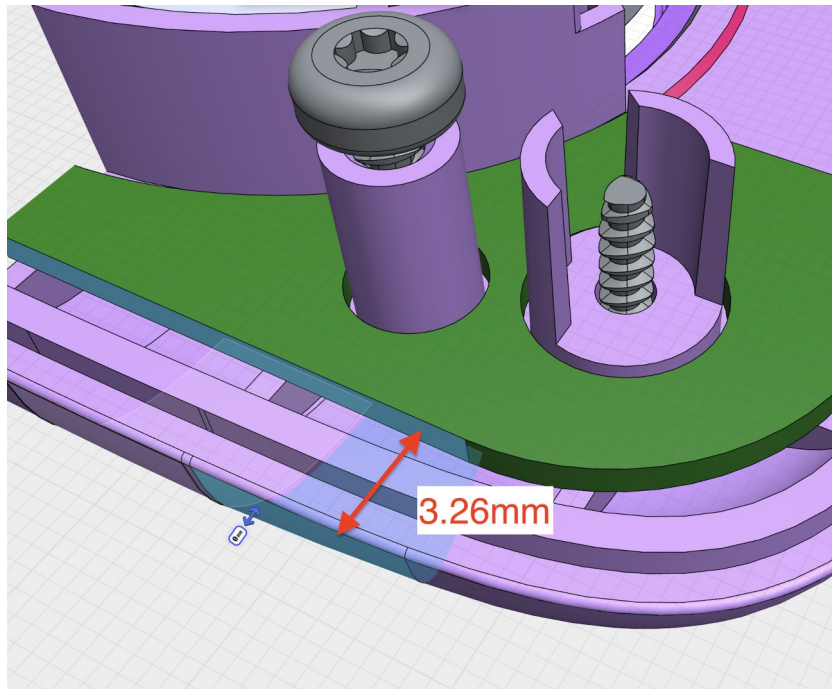
Antenna-to-body distance

The minimum distance between the LoRa antenna and the human body is controlled or limited by the plastic enclosure the antenna is installed in. A few views from the mechanical engineering 3D model show the worst-case distances. Note that these views hide several components (the main circuit board as well as the upper plastic body):

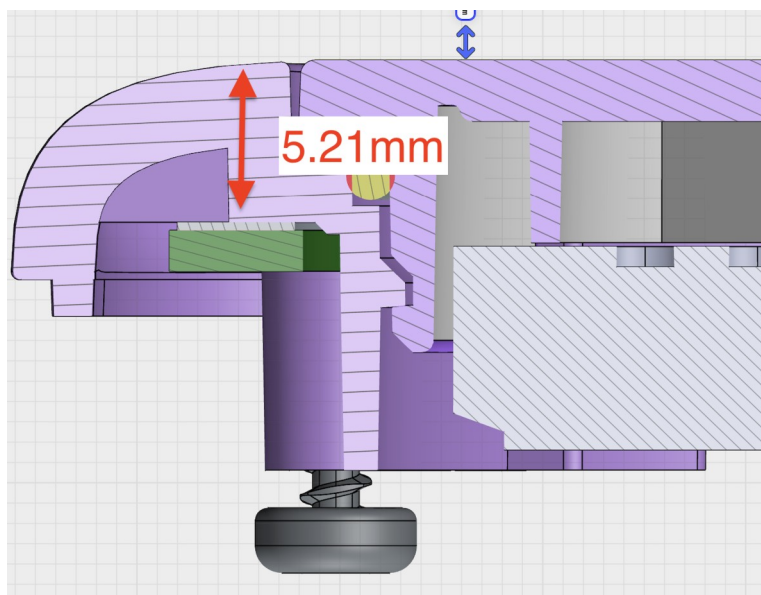


2.91 mm between the bottom edge of the antenna (green body) and the bottom outer wall of the plastic enclosure (light purple body)

36 Clyde Street
San Francisco, CA 94107
info@safely-you.com
415.579.3630

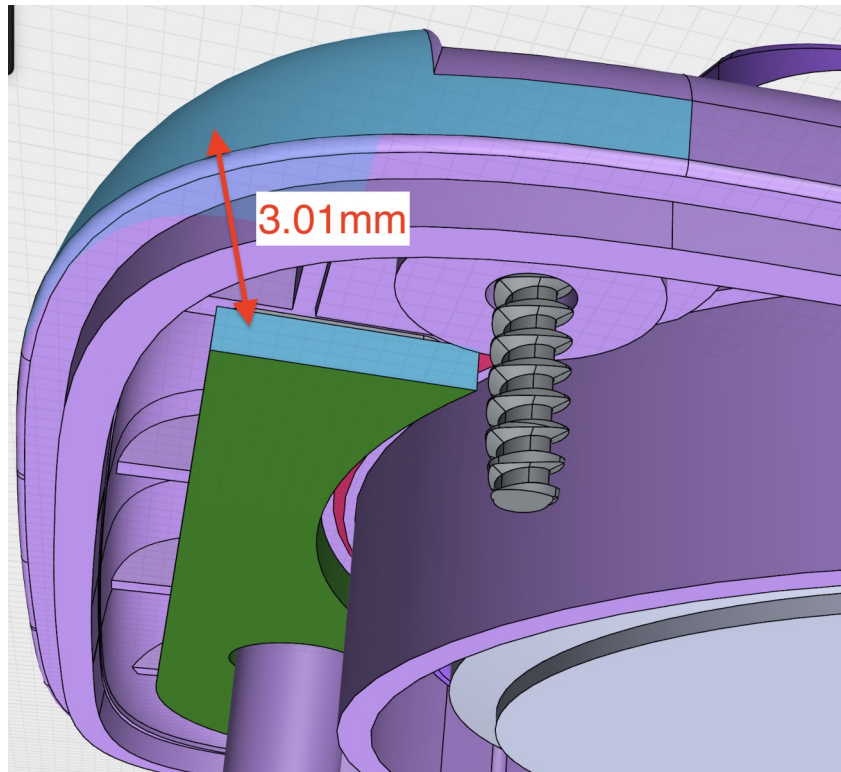


3.26 mm from the side of the antenna (green body) to the edge of the plastic enclosure (light purple body)



5.21 mm from the bottom face of the antenna (green body) to the bottom edge of the plastic enclosure (light purple body)

36 Clyde Street
San Francisco, CA 94107
info@safely-you.com
415.579.3630



3.01 mm from the top edge of the antenna (green body) and the curved edge of the plastic enclosure (light purple body)

The worst-case distance between the 915 MHz antenna and human skin would therefore be 2.91 mm. In most cases, users would be wearing clothing between the device and their skin, but it's difficult to estimate the effect clothing would have on the skin-to-antenna distance due to the huge variation that exists in clothing material, design, thickness, etc.

Conclusion

To summarize, the key parameters are:

- RF transmission band: 915 MHz
- Maximum transmission duration: 290.1 milliseconds
- Minimum time between transmissions: 13.3 seconds
- Maximum transmission power: +22 dBm
- Minimum distance between the antenna and the human body: 2.91mm