# RF Exposure information

The HUB is classified as mobile.
The HUB model 2810 includes 2 transmitters operating according to FCC part 15 subpart C section 15.247 (FHSS) in frequency range 905.6-926 MHz and in 2402-2480 MHz.

The HUB model 2820 includes 2 transmitters operating according to FCC part 15 subpart C section 15.247 (FHSS) in frequency range 905.6-926 MHz and in 2402-2480 MHz and approved by FCC cellular module, FCC ID XMR201707BG96.

Limit for power density for general population/uncontrolled exposure is f/1500 $mW/cm^2$ for 300 – 1500 MHz frequency range:

$P = 905.6/1500 = 0.6\ mW/cm^2$

Limit for power density for general population/uncontrolled exposure is 1 $mW/cm^2$ for 1500 -100000 MHz frequency range (for 2.4 GHz).

The power density $\mathbf{P\ (mW/cm^2) = P_T / 4\pi r^2}$

$P_T$ is the transmitted power, which is equal to the peak transmitter output power plus maximum antenna gain, the maximum equivalent isotropically radiated power EIRP is

## HUB model 2810

1) In 905.6-926 MHz range

$$P_T = 14.32\ dBm + 2.2\ dBi = 16.52\ dBm = 44.9\ mW.$$

The power density at 20 cm (minimum safe distance, required for mobile devices), calculated as follows:

$$44.9\ mW / 4\pi\ (20\ cm)^2 = 0.009\ mW/cm^2 << 0.6\ mW/cm^2$$

2) In 2402-2480 MHz range

$$P_T = -0.16\ dBm + 2.5\ dBi = 2.34\ dBm = 1.7\ mW.$$

The power density at 20 cm (minimum safe distance, required for mobile devices), calculated as follows:

$$1.7\ mW / 4\pi\ (20\ cm)^2 = 3.4 \times 10^{-4}\ mW/cm^2 << 1\ mW/cm^2$$

**Summation**
When all the antennas are at least 20 cm away from the user but individual antennas cannot be separated by 20 cm from each other, the following equation shall be fulfilled

$$S1/Limit + S2/Limit < 1, \text{ i.e.}$$
$$0.009\ mW/cm^2 / 0.6\ mW/cm^2 + 3.4 \times 10^{-4}\ mW/cm^2 / 1\ mW/cm^2 = 0.015 + 0.0003 =$$
$$= 0.0153 < 1$$

General public cannot be exposed to dangerous RF level.

## HUB model 2820

1) In 905.6-926 MHz range

$$P_T = 16.22 \text{ dBm} + 2.2 \text{ dBi} = 18.42 \text{ dBm} = 69.5 \text{ mW}.$$

The power density at 20 cm (minimum safe distance, required for mobile devices), calculated as follows:

$$69.5 \text{ mW} / 4\pi (20 \text{ cm})^2 = 0.01 \text{ mW/cm}^2 << 0.6 \text{ mW/cm}^2$$

2) In 2402-2480 MHz range

$$P_T = -1.03 \text{ dBm} + 2.5 \text{ dBi} = 1.47 \text{ dBm} = 1.4 \text{ mW}.$$

The power density at 20 cm (minimum safe distance, required for mobile devices), calculated as follows:

$$1.4 \text{ mW} / 4\pi (20 \text{ cm})^2 = 2.79 \times 10^{-4} \text{ mW/cm}^2 << 1 \text{ mW/cm}^2$$

3) Maximum conducted output power given in FCC ID:XMR201707BG96 module grant is 0.995 mW = 29.98 dBm in 1710-1785 MHz range.

According to the applicant declaration the duty cycle cannot be more than 99%, so, the averaged power is 29.68 dBm

$$P_T = 29.68 \text{ dBm} + 3.16 \text{ dBi} = 32.84 \text{ dBm} = 1923 \text{ mW}.$$

The power density at 20 cm (minimum safe distance, required for mobile devices), calculated as follows:

$$1923 \text{ mW} / 4\pi (20 \text{ cm})^2 = 0.38 \text{ mW/cm}^2 < 1 \text{ mW/cm}^2$$

**Summation**

When all the antennas are at least 20 cm away from the user but individual antennas cannot be separated by 20 cm from each other, the following equation shall be fulfilled

$$S1/\text{Limit} + S2/\text{Limit} + S3/\text{Limit} < 1, \text{ i.e.}$$

$$0.01 \text{ mW/cm}^2 / 0.6 \text{ mW/cm}^2 + 2.79 \times 10^{-4} \text{ mW/cm}^2 / 1 \text{ mW/cm}^2 + 0.38 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2 =$$
$$0.017 + 0.0003 + 0.38 = 0.3973 < 1$$

Therefore, the HUB including approved module complies with FCC RF exposure limit for mobile device for general population.

General public cannot be exposed to dangerous RF level.