

1 Test Sample Description:

Product Name: COMFORT, VIVID

Functional Description: The Comfort/Vivid is a compact, low power, cost effective LoRa multi-sensor for IoT applications. The product is designed to transmit in a North American ISM band.

Power supply: Internal Battery

LoRa:

Frequency Range: 903 – 914.2 MHz

Mode of operation: DTS

Antenna Description: PCB Max Gain: 2.2 dBi

LoRa:

Frequency Range: 902.3 – 914.9 MHz

Mode of operation: DSS

Antenna Description: PCB Max Gain: 2.2 dBi

Prepared for: Tektelic Communication Inc.
7657 10th Street NE
Calgary, Alberta
Canada
T2E 8X2
Telephone: 1-403-338-6910

2 Determination of exemption.

2.1 Limits for General Population/Uncontrolled Exposure: 47 CFR 1.1310 Table 1 (B)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, S as per the respective limits in Table 1 below, at a distance, d , of 20 cm (Mobile condition) from the EUT.

TABLE 1—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 (minutes)
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
Where f is in MHz			*Plane-wave equivalent power density	

Therefore:

MPE for COMFORT and VIVID from 902.3 MHz to 914.9 MHz.

The worst-case scenario for LoRa Radio is at 902.3 MHz is

$$S = f/1500$$

$$S = 902.3 / 1500$$

$$S = 0.6015 \text{ mW/cm}^2, \text{ for General Population/Uncontrolled Exposure}$$

3 Calculation:

Using equation i(B) as per determination of exemption, minimum antenna separation distance of 20 cm from the human body.

TX (Mode)	Frequency (MHz)	Max Conducted RF Output 100% Duty Cycle (dBm)	Max. antenna gain (dBi)	EIRP 100% Duty Cycle (dBm)	EIRP 100% Duty Cycle (mW)
LoRa 500 KHz DTS	903.0	14.10	2.2	16.3	42.66
	907.8	14.17	2.2	16.37	43.35
	914.2	13.92	2.2	16.12	40.93
LoRa 125 KHz DSS	902.3	13.54	2.2	15.74	37.50
	908.7	13.59	2.2	15.79	37.93
	914.9	13.47	2.2	15.67	36.90
Maximum output power limitation for LoRa (As per tuning procedure)		15	2.2	17.2	52.48
+15 dBm is the absolute maximum powers that LoRa chip is capable to handle					

Using worst case scenario with 100% duty Cycle, the highest measured EIRP or $[P \times G(\text{numeric gain})]$ value for the LoRa transmitter was rounded up to 53.0 mW.

Using the highest transmitted power at a distance of 20 cm in the equation below:

$$S = \text{EIRP} / (4\pi R^2)$$

Where: S, power density in 'mW/cm²'

EIRP, Effective Isotropic Radiated Power in 'mW'

R, distance to the center of the radiation of the antenna in 'cm'

The RF exposure from the radio is less than the limit specified as shown below and meets the exemption criteria.

$$S \text{ (mW/cm}^2\text{)} = (53 \text{ mW}) / (4 \times \pi \times 20^2)$$

$$S = 0.010544014 \text{ mW/cm}^2 \lll 0.6015 \text{ mW/cm}^2 \text{ (max limit)}$$

$$\text{Rounded up } S = 0.0106 \text{ mW/cm}^2 \lllllllll 0.6015 \text{ mW/cm}^2 \text{ (max limit)}$$

To determine the minimum safe distance

$$R = \sqrt{[\text{EIRP} / (4\pi S)]}$$

$$R = \sqrt{[53 / (4\pi \times 0.0106)]}$$

$$R = 2.647982965 \text{ cm}$$

$$\text{Rounded up } R = 2.7 \text{ cm}$$

4 Conclusion:

The manufacturer manual specified a minimum safe distance of 20 cm.

EUT meet SAR exemption limit