1 Test Sample Description:

Product Name:	Bow keypad
Functional Description:	The Bow Keypad is a CR2032 battery powered device. It consists of a three-button switch matrix and the Si4010 MCU/Transmitter. Transmitter will transmit at 25 ms intervals on opposite channels (431.06, 433.06 MHz) as long as a button is held and for 0.5 seconds after the button is released. Each transmission is 5 milliseconds long, so the transmit duty is 10% on each frequency.
Power supply:	Internal Battery
Radio Information	
Frequency Range:	431.06 MHz and 433.06MHz
Mode of operation:	FSK
Antenna Description:	PCB Max Gain: -6.0 dBi
FCC ID:	OV9RFBOWPAD
Category:	Mobile/Fix

Prepared for: Spyder Controls Corp

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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/cm2)	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/f2	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:

The worst-case scenario for LoRa Radio is at 431.06 MHz is

S = f/1500

S = 431.06 / 1500

S = 0.287373333 mW/cm2, for General Population/Uncontrolled Exposure

S = 0.2874 mW/cm2, for General Population/Uncontrolled Exposure

3 Calculation:

TX (Mode)	Frequency (MHz)	Measured Radiated Peak Field Strength (E) @ 3m (dBµv/m)	Radiated EIRP EIRP(dBm)=[E(dBµV/m) − 95.3] (dBm)	EIRP (mW)
Continuous	431.06	91.1	-4.2	0.380
	433.06	91.82	-3.48	0.449

Absolute Worst Case scenario				
Maximum output power limitation (As per tuning procedure)	Max. Transmit Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
	10	-3.84	6.16	4.1305
+10 dBm is the absolute maximum powers that Si4010 chip is capable to handle				

Using worst case scenario, the highest calculated EIRP or [P*G(numeric gain)] value for the radio was rounded up to 4.1 mW.

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

$S = EIRP / (4\pi R2)$

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.

$S (mW/cm2) = (4.1 mW) / (4 \times \pi \times 20^2)$

S = 0.000815669 mW/cm2 <<< 0.2874 mW/cm2 (max limit)

Rounded up S = 0.00082 mW/cm2 <<<<<<<<< 0.2874 mW/cm2 (max limit)

To determine the minimum safe distance

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

$R = \sqrt{[4.1 / (4\pi \times 0.2874)]}$

R = 1.06547586 cm

Rounded up R = 1.1 cm

4 Conclusion:

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

EUT meet SAR exemption limit