H.B. Compliance Solutions

Maximum Permissible Exposure Statement

For the

CoreKinect

CATLRA1

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1. Applicable Standard

According to §1.1307 the criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter. Test Limits

Evaluated against exposure limits: General Use _X_ or Controlled Use ___

Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	*100	6
3.0–30	1842/f	4.89/f	*900/f²	6
30–300	61.4	0.163	1.0	6
300–1,500	.....	.....	f/300	6
1,500–100,000	.....	.....	5	6
(B) 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

f = frequency in MHz* = Plane-wave equivalent power density
RF exposure compliance will need to be determined with respect to 1.1307(c) and (d) of the FCC rules.
The emissions should be within the limits at 300kHz in the above table. (Use 300kHz limits for 150kHz)

2. Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

S = PG/4πR2

Where,

S = power density (mW/cm2)
P = output power at the antenna terminal (mW)
G = gain of transmit antenna (numeric)
R = distance from transmitting antenna (cm)

For Bluetooth Transmitter

Maximum peak output power at antenna input terminal = 6.80 (dBm)
Maximum peak output power at antenna input terminal = 4.78 (mW)
Antenna gain (typical) = 2.5(dBi)
Maximum antenna gain = 1.8(numeric)
Prediction distance = 20 (cm)
Prediction frequency = 2480 (MHz)
MPE limit for uncontrolled exposure at prediction frequency = 1 (mW/cm^2)
Power density at prediction frequency = 0.00171 (mW/cm^2)

To solve for the minimum mounting distance required;

R = √ (PG/4πS)

R = √ (4.8 x 1.8 / 4π x 0.00245) = 20 cm (Based on continuous transmission)

For LoRa Transmitter

Maximum peak output power at antenna input terminal = -14.89 (dBm) *
Maximum peak output power at antenna input terminal = 0.0324 (mW)
Antenna gain (typical) = 0 (dBi)
Maximum antenna gain = 1.0 (numeric)
Prediction distance = 20 (cm)
Prediction frequency = 902.3 (MHz)
MPE limit for uncontrolled exposure at prediction frequency = 0.6 (mW/cm^2)
Power density at prediction frequency = 0.00000644 (mW/cm^2)

*Includes 1dB of manufacturer output power tolerance.

To solve for the minimum mounting distance required;

$R = \sqrt{(PG/4\pi S)}$

$R = \sqrt{(65 \times 1.0 / 4\pi \times 0.01293)}$ = 20 cm (Based on continuous transmission)

Note:

Both transmitters (Bluetooth and LoRa) do not operate at the same time.

3. Simultaneous Transmission Evaluation

Limit

The sum of the ratios of the peak or spatially averaged results to the applicable frequency dependent MPE limits must be <1 at all locations where users and bystanders can by exposed.

Calculation

Mode	Cellular Modem Power Density/Limit	2.4GHz Bluetooth Power Density/Limit	900MHz Lora Power Density/Limit	∑(Power Density/Limit) of Cellular+Lora/Bluetooth
Cellular Modem	0.549			
Bluetooth		0.00171		0.5507
Lora			0.00000644	0.5491

The Cellular and Bluetooth transmitter and the Cellular with Lora, the aggregated (power density/limit) is smaller than 1, and the MPE of 2 collocated transmitters is compliant.

Note: FCC ID for the pre-certified Cellular Modem 2ANPO00NRF9160.

END OF TEST REPORT