RF EXPOSURE EVALUATION

EUT Specification

EUT	LoRa Module
Model Number	HPNI01
FCC ID	2ASEO-HPNI01
Antenna gain (Max)	Ant. 1: 2.15dBi; Ant. 2: 2.15dBi
Operation Frequency	902.0 MHz to 928.0 MHz
Modulation	LoRa
Rating	DC 3.3V, 500mA
Max. output power	Ant. 1: 13.18dBm (20.797mW); Ant. 2: 17.33 dBm (54.0754 mW)

Test Requirement:

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm^2)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	**--**	**--**	**F/300**	**6**
1500-100000	**--**	**--**	**5**	**6**
(B) Limits for General Population/Uncontrol Exposures				
300-1500	**--**	**--**	**F/1500**	**6**
1500-100000	**--**	**--**	**1**	**30**

Friis transmission formula: Pd= (Pout*G)\ (4*pi*R^2)

Where

Pd= Power density in mW/cm^2

Pout=output power to antenna in mW

G= Numeric gain of the antenna relative to isotropic antenna

Pi=3.1416

R= distance between observation point and center of the radiator in cm=20cm

Pd the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the nd total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

For multiple RF sources: Multiple RF sources are exempt if:
in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation

$$\sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

$Evaluated_k$: the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.
Exposure $Limit_k$: either the general population/uncontrolled maximum permissible exposure (MPE) or specific Absorption rate (SAR) limit for each fixed, mobile, or portable RF source k.

Measurement Result

Antenna gain 1: 2.15dBi, Antenna gain 2: 2.15dBi

Mode	Ant.	Channel Freq. (MHz)	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain （Numeric）	Evaluation result (mW/cm^2)	Power density Limits (mW/cm^2)
GFSK	1	902	13.18	13±1	14	1.64	0.008198	1
GFSK	2	902	17.33	17±1	18	1.64	0.020593	1

Maximum Simultaneous transmission MPE Ratio for LoRa Ant. 1 & LoRa Ant. 2

Maximum MPE ratio (LoRa Ant. 1)	Maximum MPE ratio (LoRa Ant. 2)	∑ MPE ratios	Limit	Results
0.008198	0.020593	0.028791	1.000	Pass

Signature:

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