Maximum Permissible Exposure Evaluation

FCC ID: 2A2GJ-HRI-3632

1. Client Information

Applicant	:	Heltec Automation Technology Co., Ltd
Address	:	1f, No.54,56,58, Zirui North Street, Gaoxin District, Chengdu, China.
Manufacturer	:	Heltec Automation Technology Co., Ltd
Address	:	1f, No.54,56,58, Zirui North Street, Gaoxin District, Chengdu, China.

2. General Description of EUT

EUT Name	:	Wireless Aggregator	
Models No.	:	HRI-3632, HRI-3631, HRI-3633, HRI-3634, HRI-3631S, HRI-361L, HRI-361G, HRI-3632S, HRI-3632L, HRI-3632G, HRI-3633S, HRI-3633L, HRI-3633G	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is Different sales areas, different name.	
Sample ID	:	HC-C-202406-0198-01-03-1#&HC-C-202406-0198-01-03-2#	
Product Description	:	Operation Frequency:	LORA: 902.3MHz~914.9MHz(125KHz) 923.3MHz~927.5MHz(500KHz) 802.11b/g/n(HT20): 2412MHz~2462MHz 802.11n(HT40): 2422MHz~2452MHz
Power Rating	:	INPUT: DC 7~24V DC 3.6V 4*1900mAh Rechargeable Li-ion battery	
Software Version	:	HRI-3632.V1.10	
Hardware Version	:	HRI-3632.V1.10	
Connecting I/O Port(S)	:	Please refer to the User's Manual	
Remark	:	the MPE report used the EUT-2(HC-C-202406-0198-01-03-2#).	

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MPE Calculations for FCC

1. Antenna Gain:

Antenna	Brand	Model Name	Type	Antenna Gain(dBi)
LORA	N/A	N/A	Chip	1.32
2.4G WIFI	N/A	N/A	Spring	2.0

2. EUT Operation Condition:

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

3. Exposure Evaluation:

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

$$S=(PG)/4\pi R^2$$

Where

S: power density
P: power input to the antenna
G: power gain of the antenna in the direction of interest relative to an isotropic radiator.
R: distance to the center of radiation of the antenna

4. Simultaneous transmission MPE Considerations

According to KDB447498: All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

This means that:

∑ of MPE ratios ≤ 1.0

5. Standalone MPE Evaluation:

LORA(DSS) Worst Maximum MPE Result									
Mode	N_{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/cm^2) [S]	Limit of Power Density (mW/cm^2) (S)
LORA	1	902.3	11.468	11±1	12	1.32	20	0.00427	0.6015
		908.9	11.120	11±1	12	1.32	20	0.00427	0.6015
		914.9	10.688	10±1	11	1.32	20	0.00339	0.6015
Note: N_{TX}= Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.									

LORA(DTS) Worst Maximum MPE Result									
Mode	N_{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/cm^2) [S]	Limit of Power Density (mW/cm^2) (S)
LORA	1	923.3	10.144	10±1	11	1.32	20	0.00339	0.6015
		925.1	9.941	9±1	10	1.32	20	0.00270	0.6015
		927.5	9.727	9±1	10	1.32	20	0.00270	0.6015
Note: N_{TX}= Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak Output Power.									

2.4G WIFI Worst Maximum MPE Result								
Mode	N_{TX}	Freq. (MHz)	Conducted Power(max) (dBm)	Turn-up Power (dB)	Max tune up power (dBm) [P]	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/cm^2) [S]
802.11b	1	2412	15.10	15±1	16	2.0	20	0.01255
		2437	14.69	14±1	15	2.0	20	0.00997
		2462	14.50	14±1	15	2.0	20	0.00997
802.11g	1	2412	14.81	14±1	15	2.0	20	0.00997
		2437	14.58	14±1	15	2.0	20	0.00997
		2462	13.07	13±1	14	2.0	20	0.00792
802.11n (HT20)	1	2412	13.04	13±1	14	2.0	20	0.00792
		2437	12.91	12±1	13	2.0	20	0.00629
		2462	12.23	12±1	13	2.0	20	0.00629
802.11n (HT40)	1	2422	11.33	11±1	12	2.0	20	0.00450
		2437	12.72	12±1	13	2.0	20	0.00629
		2452	10.24	10±1	11	2.0	20	0.00400
Note: **N_{TX}= Number of Transmit Antennas** **RF Output power specifies that Maximum Conducted Output Power.**								

Remark:
1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.
4. Only the worst power was evaluated for each wireless function

6. Conclusion:

As specified in Table 1B of 47 CFR 1.1310- Limits for Maximum Permissible Exposure (MPE),

Limits for General Population/ Uncontrolled Exposure

Frequency Range (MHz)	Power density (mW/cm^2)
300-1,500	F/1500
1,500-100,000	1.0

7. Summary simultaneous transmission information

The sample supports two antennas for LORA Antenna and WLAN Antenna.
The LORA Antenna and WLAN Antenna can transmit simultaneous.
The LORA Antenna and WLAN Antenna with two different Antenna.
According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑ of MPE ratios ≤ 1.0

8. Summary simultaneous transmission results

LORA ANT. +2.4G WIFI ANT. Maximum Simultaneous transmission MPE Ratios is

0.00710+0.01255=0.01965⩽1.0.

9. Conclusion:

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----END OF THE REPORT-----