Maximum Permissible Exposure Evaluation

FCC ID: 2A2GJ-HTM7603

1. Client Information

Applicant	:	Heltec Automation Technology Co., Ltd
Address	:	1st floor, No. 54, 56, 58 zirui North Street, High-tech Zone, Chengdu city, China
Manufacturer	:	Heltec Automation Technology Co., Ltd
Address	:	1st floor, No. 54, 56, 58 zirui North Street, High-tech Zone, Chengdu city, China

2. General Description of EUT

EUT Name	:	Heltec Light Hotspot	
Models No.	:	HT-M7603	
Model Difference	:	----	
Product Description	:	Operation Frequency:	DTS: LoRa(500KHz): 923.3MHz-927.5MHz DSS: LoRa(125KHz): 902.3MHz-914.9MHz 802.11b/g/n(HT20): 2412MHz~2462MHz 802.11n(HT40): 2422MHz~2452MHz
Power Rating	:	Adapter(DSS12D-0502000-E) Input: 100-240V~50/60Hz 0.5A Output: 5V2A	
Software Version	:	N/A	
Hardware Version	:	N/A	
Connecting I/O Port(S)	:	Please refer to the User's Manual	
Remark	:	the MPE report used the EUT-2(RW-C-202205-0119-4-2#).	

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MPE Calculations

1. Antenna Gain:

Antenna	Brand	Model Name	Type	LoRa Antenna Gain(dBi)
Lora	N/A	N/A	Dipole	3.0

Antenna	Brand	Model Name	Type	2.4G WIFI Antenna1 Gain(dBi)
2.4G WIFI	N/A	N/A	FPC	3.0

Antenna	Brand	Model Name	Type	2.4G WIFI Antenna2 Gain(dBi)
2.4G WIFI	N/A	N/A	FPC	3.0

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 FHSS

Channel	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)
Channel 01	21.25	21±1	22	3.0	20	0.0629	0.6015
Channel 32	21.72	21±1	22	3.0	20	0.0629	0.6015
Channel 64	21.12	21±1	22	3.0	20	0.0629	0.6015

LoRa DTS

Channel	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)
Channel 01	27.20	27±1	28	3.0	20	0.250	0.615
Channel 05	27.18	27±1	28	3.0	20	0.250	0.615
Channel 08	27.09	27±1	28	3.0	20	0.250	0.615

2.4G WiFi MPE Result Antenna 1								
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	14.88	14±1	15	3.0	20	0.0125
		2437	15.84	15±1	16	3.0	20	0.0158
		2462	15.69	15±1	16	3.0	20	0.0158
802.11g	1	2412	13.73	13±1	14	3.0	20	0.0099
		2437	13.98	13±1	14	3.0	20	0.0099
		2462	14.07	14±1	15	3.0	20	0.0125
802.11n20	1	2412	13.36	13±1	14	3.0	20	0.0099
		2437	13.59	13±1	14	3.0	20	0.0099
		2462	13.77	13±1	14	3.0	20	0.0099
802.11n40	1	2422	12.52	12±1	13	3.0	20	0.0079
	1	2437	14.71	14±1	15	3.0	20	0.0125
	1	2452	13.21	13±1	14	3.0	20	0.0099

Note:
N_{TX}= Number of Transmit Antennas
RF Output power specifies that Maximum Conducted Peak Output Power.

2.4G WiFi MPE Result Antenna 2								
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	16.33	16±1	17	3.0	20	0.0198
		2437	16.38	16±1	17	3.0	20	0.0198
		2462	16.25	16±1	17	3.0	20	0.0198
802.11g	1	2412	15.28	15±1	16	3.0	20	0.0158
		2437	15.37	15±1	16	3.0	20	0.0158
		2462	15.09	15±1	16	3.0	20	0.0158
802.11n20	1	2412	15.47	15±1	16	3.0	20	0.0158
		2437	15.26	15±1	16	3.0	20	0.0158
		2462	14.98	14±1	15	3.0	20	0.0125
802.11n40	1	2422	14.57	14±1	15	3.0	20	0.0125
	1	2437	16.07	16±1	17	3.0	20	0.0198
	1	2452	14.94	15±1	16	3.0	20	0.0158
Note: N_{TX}= Number of Transmit Antennas RF Output power specifies that Maximum Conducted Peak 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 three antennas for LoRa and WLAN. The LoRa and WLAN can transmit simultaneous. The WLAN 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 + 2.4G Wifi Maximum Simultaneous transmission MPE Ratios is 0.4065+0.0158+0.0198=0.4421 ⩽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.

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