



# RF Exposure Evaluation

## FCC ID: 2A2GJ-HRI-3641

### 1. Client Information

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

### 2. General Description of EUT

<b>EUT Name</b>	:	Capsule Sensor V3	
<b>Model(s) No.</b>	:	HRI-3641, HRI-3642, HRI-3643, HRI-364B, HRI-364D, HRI-364G, HRI-364R, HRI-364S, HRI-364L, HRI-364X, HRI-4851, HRI-4852, HRI-4853	
<b>Model Difference</b>	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name.	
<b>Product Description</b>	:	Operation Frequency:	2.4GWiFi: 2412MHz~2462MHz Bluetooth LE 5.0: 2402MHz~2480MHz LORA(125KHz): 902.3MHz~914.9MHz LORA(500KHz): 903MHz~914.2MHz
	:	Antenna Gain:	3.3dBi SMD Patch Antenna for BT&WIFI 1.32dBi Chip Antenna for LoRa
<b>Power Rating</b>	:	USB INPUT: DC 5V/1A DC 3.7V 250mAh Rechargeable Li-ion battery	
<b>Software Version</b>	:	HRI-3641.V1.0	
<b>Hardware Version</b>	:	HRI-3641.V1.0	
<b>Remark:</b>			
(1) The above antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.			
(2) The antenna gain provided by the applicant, the adapter and the verified for the RF conduction test provided by TOBY test lab.			
(3) The above antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.			

**Note:** More test information about the EUT please refer the RF Test Report.

## The RF Exposure Evaluation for FCC:

### SAR Test Exclusion Calculations

#### 1. FCC: According to KDB 447498 D01 Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies v06.

##### (1) Clause 4.3: General SAR test reduction and exclusion guidance

##### Sub clause 4.31: Standalone SAR test exclusion considerations

##### 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6GHz at test separation distance $\leq 5$ mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0$  for 1-g SAR

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 7.5.0$  for 10-g SAR

#### 2. Summary simultaneous transmission for SAR Exclusion

The SAR exemption limits outlined in clause 4.3.2(b) of KDB 447498 have been derived based on an approximate SAR value of 0.4 W/kg using half-wave dipole antennas Footnote 1. As such, when simultaneous transmitter SAR evaluations include transmitters that have been exempt from routine SAR evaluation, the SAR must be estimating based on the ratio between the maximum tune-up tolerance limit of the transmitter that has been exempt and the exemption limit at the specific distance and frequency for that transmitter. This ratio must be multiplied by 0.4 W/kg (2.0 W/kg for controlled use and 1.0 W/kg for limb worn devices) in order to calculate the estimated SAR level.

The estimate SAR value is calculated based the following equation:

(maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) \* 0.4W/kg

- 1)  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}/x}]$  W/kg, for test separation distances  $\leq 50$  mm;

where  $x = 7.5$  for 1-g SAR and  $x = 18.75$  for 10-g SAR.

- 2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is  $> 50$  mm.<sup>37</sup>

The  $[\Sigma$  of (the highest measured or estimated  $\Sigma$  SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] +  $[\Sigma$  of MPE ratios] is  $\leq 1.0$ .

The SAR to peak location separation ratios of all simultaneously transmitting antenna pairs operating in portable device exposure conditions are all  $\leq 0.04$ , and the  $[\Sigma$  of MPE ratios] is  $\leq 1.0$ .



### 3. Calculation:

Test separation: 5mm								
LoRa Worst MPE Result								
Test Mode	Antenna	Frequency (MHz)	Conducted Power (dBm)	Turn-up Power Tolerance (dB)	Max power of tune up tolerance (dBm)	Max power of tune up tolerance (mw)	Calculation Value	Threshold Value
LoRa(DSS)	Ant1	914.9	6.509	6±1	7	5.012	0.959	3.0
LoRa(DTS)	Ant1	914.2	6.504	6±1	7	5.012	0.958	3.0

Test separation: 5mm								
(BLE&WIFI) Worst MPE Result								
Test Mode	Antenna	Frequency (MHz)	Conducted Power (dBm)	Turn-up Power Tolerance (dB)	Max power of tune up tolerance (dBm)	Max power of tune up tolerance (mw)	Calculation Value	Threshold Value
BLE-1M	Ant1	2402	5.459	5±1	6	3.981	1.234	3.0
BLE-2M	Ant1	2440	5.531	5±1	6	3.981	1.244	3.0
2.4G b	Ant1	2412	8.42	8±1	9	7.943	2.467	3.0
2.4G g	Ant1	2412	8.42	8±1	9	7.943	2.467	3.0
2.4G n20	Ant1	2412	8.32	8±1	9	7.943	2.467	3.0
2.4G n40	Ant1	2437	8.02	8±1	9	7.943	2.480	3.0

Simultaneous Transmission for SAR Exclusion			
Simultaneous Transmission for SAR Exclusion		Total Calculation Value	Limit
LoRa Ant1	BLE&2.4G WIFI Ant1		
<b>0.1278</b>	<b>0.3307</b>	<b>0.28657</b>	<b>1.0</b>
$\Sigma$ of (the highest measured or estimated SAR <sub>LoRa Ant1</sub> +SAR <sub>BLE&amp;2.4G WIFI Ant1</sub> )/1.6 = (0.1278 + 0.3307)/1.6 = 0.28657 < 1.0;			

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.

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

