

## FCC&IC RF Exposure Evaluation

### 1. Product Information

FCC ID:	2AEUPBHALV001
ISED:	20271-BHALV001
Product name	Transformer
Model number	5AT1S9
Power supply	AC 120V
Modulation Type	BLE LoRa
Antenna Type	PCB Antenna
Antenna Gain	-2.5 dBi (For BT); -3.8 dBi (For LoRa)
Bluetooth Operation frequency	2402MHz-2480MHz
Lora Operation frequency	902.5MHz – 927MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Fix Device

## 2. Evaluation method and Limit

According to ANSI/IEEE C95.1-1992, 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 §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f <sup>2</sup>	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f <sup>2</sup>	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

The MPE was calculated at **20 cm** to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna ( linear gain )

R = Distance from Transmitting Antenna

### 3. Antenna Information

Product can only use antennas certificated as follows provided by manufacturer;

Antenna Type:	Bluetooth	PCB Antenna
	LoRa	PCB Antenna
Antenna gain:	Bluetooth	-2.5dBi
	LoRa	-3.8dBi

Note: The product has two antenna, BT and LoRa can not working simultaneously .

### 4. Conducted Power

#### 4.1 Test Setup Block Diagram



#### 4.2 Test Procedure

- 1) The EUT was directly connected to the spectrum analyser and antenna output port as show in the Block diagram;
- 2) Reading peak power in peak detector.

#### 4.3 Measurement Equipment

Item	Equipment	Manufacturer	Model No.	Inventory No.	Last Cal.	Next Cal.
1	Spectrum Analyzer	Keysight	N9010A	MY56070788	2018-03-02	2019-03-01

### Conducted Power Results

#### BT V4.2

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)
GFSK	0	2402	-1.633
	19	2440	-1.448
	39	2480	-1.239

#### Lora 500KHz DTS

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)
Lora	Low	902.5	9.117
	Middle	913.7	7.870
	High	927.0	6.124

## 5. Manufacturing tolerance

### Bluetooth

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-1	-1	-1
Tolerance $\pm$ (dB)	1	1	1

### Lora

Channel	Low	Middle	High
Target (dBm)	8	8	8
Tolerance $\pm$ (dB)	2	2	2

## 6. Evaluation Results

FCC:

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
Bluetooth	2402	-2.5	0	-2.5	0.001	1.000	0.562	0.0001	1.000
LoRa	902.5	-3.8	10	6.2	0.004	1.000	0.525	0.0001	0.602

ISED:

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
Bluetooth	2402	-2.5	0	-3.8	0.000417	1.000	0.562	0.001	5.351
LoRa	902.5	-3.8	10	6.2	0.004	1.000	0.525	0.001	2.741

Remark:

1. Output power including tune up tolerance;

## 7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 and RSS-102 Issue 5 for the uncontrolled RF Exposure.

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