

TEST REPORT

Verified Code: 357154

Report No.:	E20210609628301-01-2	Application No.:	E20210609628301-01
Client:	TowerIQ, Inc.		
Address:	13723 Riverport Drive C/O Potter Electric Signal Company Saint Louis, Missouri 63043		
FCC ID:	2AXVJGUARD-BUL		
Sample Description:	In-building 2-Way Emergency Radio Communication Enhancement Booster		
Model:	TQ-Guardian B		
Test Specification:	FCC PART 90 §90.223-RF exposure		
Receipt Date:	2021-06-15		
Test Date:	2021-06-16 to 2021-07-04		
Issue Date:	2021-07-27		
Test Result:	Pass		
Prepared By: Test Engineer <i>Yu shanshan.</i>	Reviewed By: Technical Manager <i>Wu Haoting</i>	Approved By: Manager <i>John</i> 	
Other Aspects:			
Note: Note			
Abbreviations: ok / P = passed; fail / F = failed; n.a. / N = not applicable;			
The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT.			



DIRECTIONS OF TEST

- 1. This station carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.**
- 2. The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.**
- 3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.**

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1 Applicant information

1.1 Client information

Name: TowerIQ, Inc.
Address: 13723 Riverport Drive C/O Potter Electric Signal Company Saint Louis, Missouri 63043

1.2 Manufacturer and Factory

Manufacture Name: Potter Elmdene SZ Branch
Address: Room 1483A, Hangdu Plaza, No. 1006 Huaifu road, Huahang Community, Huaqiang North Street, Futian District, Shenzhen Bank Name: China Merchants Bank, Head Office, Shenzhen, P.R. China
Factory: Potter Elmdene SZ Branch
Address: Room 1483A, Hangdu Plaza, No. 1006 Huaifu road, Huahang Community, Huaqiang North Street, Futian District, Shenzhen Bank Name: China Merchants Bank, Head Office, Shenzhen, P.R. China

2 General description of EUT

2.1 Basic description of EUT

Product Name: In-building 2-Way Emergency Radio Communication Enhancement Booster
Product Model: TQ-Guardian B
Adding Model: /
Trade Name: 
Power Supply: AC 100~240V, 50/60Hz
Typical working voltage: AC 110V, 50/60Hz
Power cord: AC power cord
Frequency Band^①: 700MHz Band:
Downlink: 758MHz ~ 775MHz, Uplink: 788MHz ~ 805MHz
800MHz Band:
Downlink: 851MHz ~ 861MHz, Uplink: 806MHz ~ 816MHz
Nominal Output Power: Downlink: 33dBm
Uplink: 27dBm
Nominal System Gain: Downlink: 80dB
Uplink: 80dB
EUT Operating Temperature: -20 °C to +50 °C
Operating Humidity: 5% to 95%
Antenna Type: N/A^②

NOTE 1: This EUT is a broadband device, which belongs to Class B signal booster.

NOTE 2: ^①PS GuardBand : Downlink 768MHz~769MHz and Uplink 798MHz ~ 799MHz.

NOTE 3: ^② It's an indoor device, The EUT does not provide antenna by Manufacturer's statement, but it is required that the Antenna gain shall not exceed **3 dBi** for Downlink and **9 dBi** for Uplink when the project is used by Manufacturer's statement.

3 Assessment result summary

Item	Assessment Requirement	Assessment Method
RF exposure	FCC PART 90 §90.223	FCC PART 1.1307(b) FCC PART 2.1091 FCC PART 2.1093

4 Radio frequency radiation exposure

4.1 Applicable Standard

According to the requirements of FCC PART 90 § 90.223, the test method of RF exposure is based on FCC PART 1.1307(b), FCC PART 2.1091 and FCC PART 2.1093, so RF exposure is calculated.

4.2 Limits for Maximum Permissible Exposure (MPE)

The limits are shown in Table 4-1.

Table 4-1 Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ₂)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

Note: f=frequency in MHz; *=Plane-wave equivalent power density

Prediction of MPE limit at given distance, equations from OET Bulletin 65, Edition 97 - 01:

$$S = (P * G) / (4 * \pi * R^2) \text{ (where PG = EIRP) Where:}$$

S = power density

P= power input to antenna

G= numeric gain of the antenna

R= distance to the center of radiation of the antenna

4.3 Test results

Devices that operate under CFR47 Part 90 are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and limit for power density for general population/uncontrolled exposure is f/1500 W/m². The output power range by Manufacturer statement is 33±1dBm for Downlink and 30±1dBm for Uplink, The maximum antenna gain is 3dBi for Downlink and 9dBi for uplink, Therefore, in this report, MPE adopts the maximum output power evaluation, that is, the maximum output power of downlink is 34dBm, and the maximum output power of uplink is 28dBm.so it has the following assessment:

4.3.1 700MHz Band:

4.3.1.1 Frequency range: 758MHz~768MHz/788MHz ~798MHz

4.3.1.1.1 Downlink (758MHz~768MHz)

Prediction frequency (MHz):	763
Maximum peak output power at antenna input terminal (dBm):	34.0
Maximum peak output power at antenna input terminal (W):	2.512
Maximum antenna gain (dBi):	3.0

Maximum RF output power (W): 5.0

MPE limit for uncontrolled exposure at predication frequency (W/ m }:
 $S = f/1500 = 763/1500$ 0.509

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.509 * 4 * 3.14}} \approx 0.8843m$$

Conversely, when $R > 0.8843m$, and $S < \frac{PG}{4\pi R^2} = \frac{5}{4 * 3.14 * 0.8843^2} \approx 0.509(W/m^2)$

4.3.1.1.2 Uplink (788MHz ~798MHz)

Prediction frequency (MHz): 793

Maximum peak output power at antenna input terminal (dBm): 28

Maximum peak output power at antenna input terminal (W): 0.63

Maximum antenna gain (dBi): 9.0

Maximum RF output power (W): 5.0

MPE limit for uncontrolled exposure at predication frequency (W/ m }:
 $S = f/1500 = 793/1500$ 0.529

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.529 * 4 * 3.14}} \approx 0.8675m$$

Conversely, when $R > 0.8675m$, and $S < \frac{PG}{4\pi R^2} = \frac{5}{4 * 3.14 * 0.8675^2} \approx 0.529(W/m^2)$

4.3.1.2 Frequency range: 768MHz~775MHz/798MHz ~805MHz

4.3.1.2.1 Downlink (768MHz~775MHz)

Prediction frequency (MHz): 771.5

Maximum peak output power at antenna input terminal (dBm): 34.0

Maximum peak output power at antenna input terminal (W): 2.512

Maximum antenna gain (dBi): 3.0

Maximum RF output power (W): 5.0

MPE limit for uncontrolled exposure at predication frequency (W/ m }:
 $S = f/1500 = 771.5/1500$ 0.515

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.515 * 4 * 3.14}} \approx 0.8792m$$

Conversely, when $R > 0.8792m$, and $S < \frac{PG}{4\pi R^2} = \frac{5}{4 * 3.14 * 0.8792^2} \approx 0.515(W/m^2)$

4.3.1.2.2 Uplink (798MHz ~805MHz)

Prediction frequency (MHz):	801.5
Maximum peak output power at antenna input terminal (dBm):	28
Maximum peak output power at antenna input terminal (W):	0.63
Maximum antenna gain (dBi):	9.0
Maximum RF output power (W):	5.0
MPE limit for uncontrolled exposure at predication frequency (W/ m }: S= f/1500=801.5/1500	0.535

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.535 * 4 * 3.14}} \approx 0.8626m$$

$$\text{Conversely, when } R > 0.8626m, \text{ and } S < \frac{PG}{4\pi R^2} = \frac{5}{4 * 3.14 * 0.8626^2} \approx 0.535(W/m^2)$$

4.3.2 800MHz Band:

4.3.2.1.1 Downlink (851MHz~861MHz)

Prediction frequency (MHz):	856
Maximum peak output power at antenna input terminal (dBm):	34.0
Maximum peak output power at antenna input terminal (W):	2.512
Maximum antenna gain (dBi):	3.0
Maximum RF output power (W):	5.0
MPE limit for uncontrolled exposure at predication frequency (W/ m }: S= f/1500=856/1500	0.571

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.571 * 4 * 3.14}} \approx 0.8349m$$

$$\text{Conversely, when } R > 0.8349m, \text{ and } S < \frac{PG}{4\pi R^2} = \frac{5}{4 * 3.14 * 0.8349^2} \approx 0.571(W/m^2)$$

4.3.2.1.2 Uplink (806MHz~816MHz)

Prediction frequency (MHz):	811
Maximum peak output power at antenna input terminal (dBm):	28
Maximum peak output power at antenna input terminal (W):	0.63
Maximum antenna gain (dBi):	9.0
Maximum RF output power (W):	5.0
MPE limit for uncontrolled exposure at predication frequency (W/ m }: S= f/1500=811/1500	0.541

$$R1 = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{5}{0.541 * 4 * 3.14}} \approx 0.8578m$$

Conversely, when $R > 0.8578\text{m}$, and $S < \frac{PG}{4\pi R^2} = \frac{5}{4 \times 3.14 \times 0.8578^2} \approx 0.541 (\text{W/m}^2)$

4.4 Test Results

The above all ,when the Maximum antenna gain is 3dBi for downlink and the shortest distance from the human specific is 0.8843m, the device is compliant with the requirement MPE limit for uncontrolled exposure.

APPENDIX A. PHOTOGRAPHS OF EUT

A.1 External photos



Top surface



Front surface-1



Front surface-2



Side surface-1



Side surface-1



Side surface-2

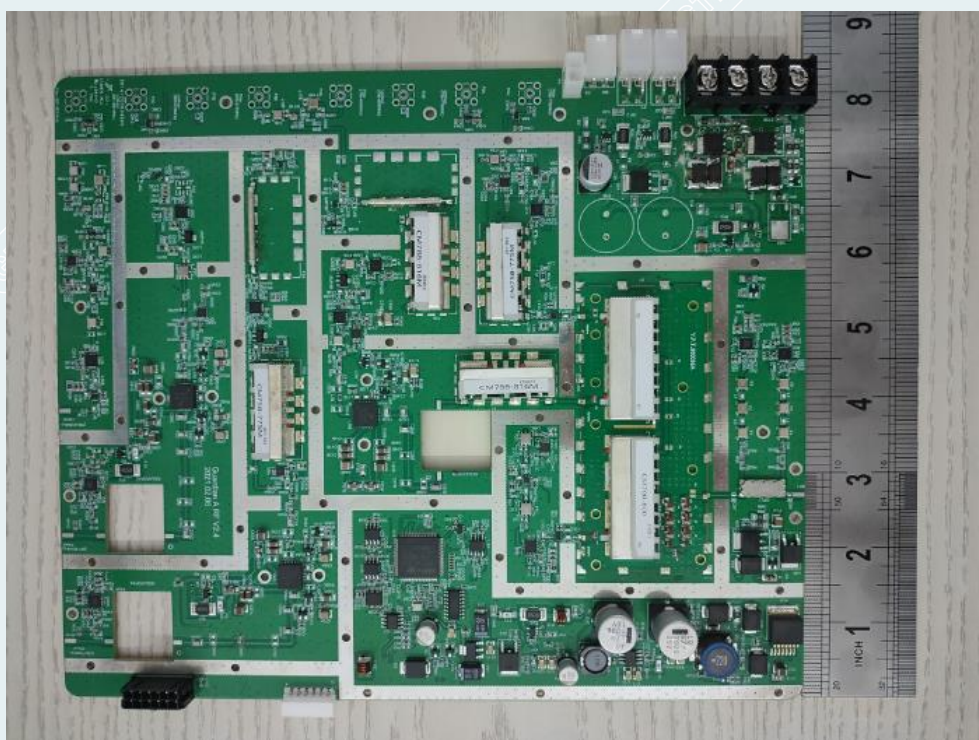
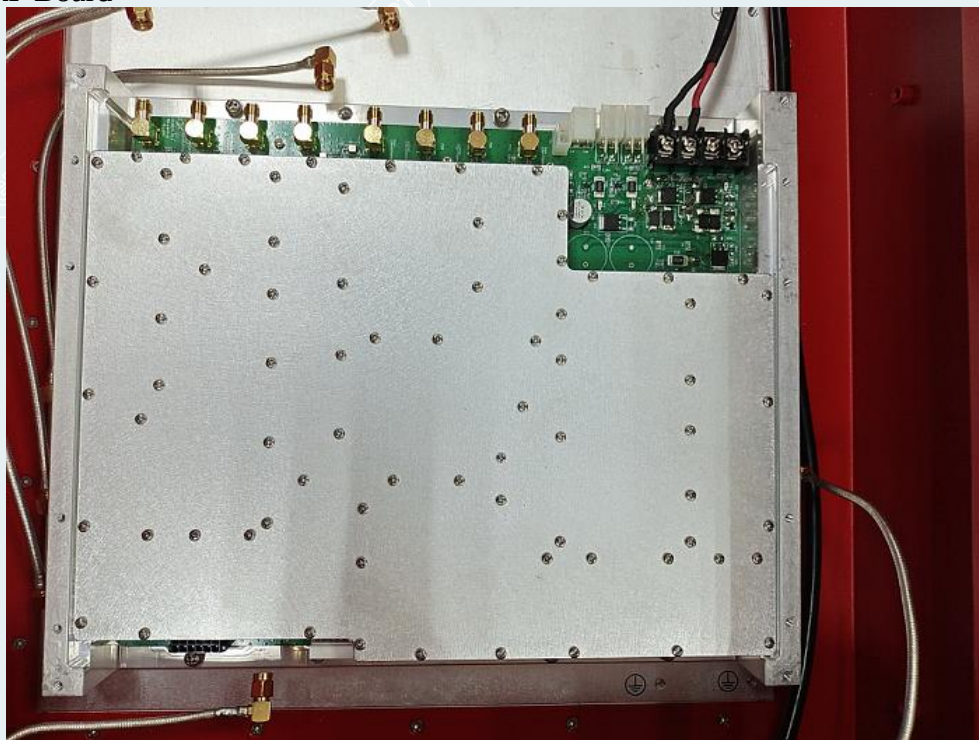


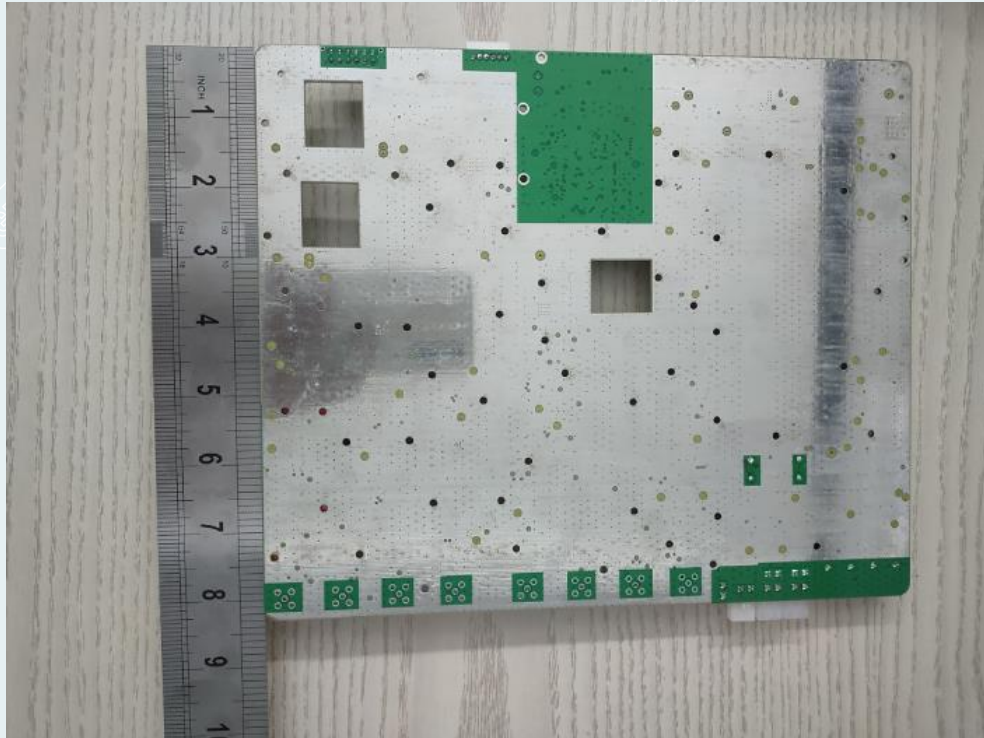
Behind surface

A.2 Internal photos

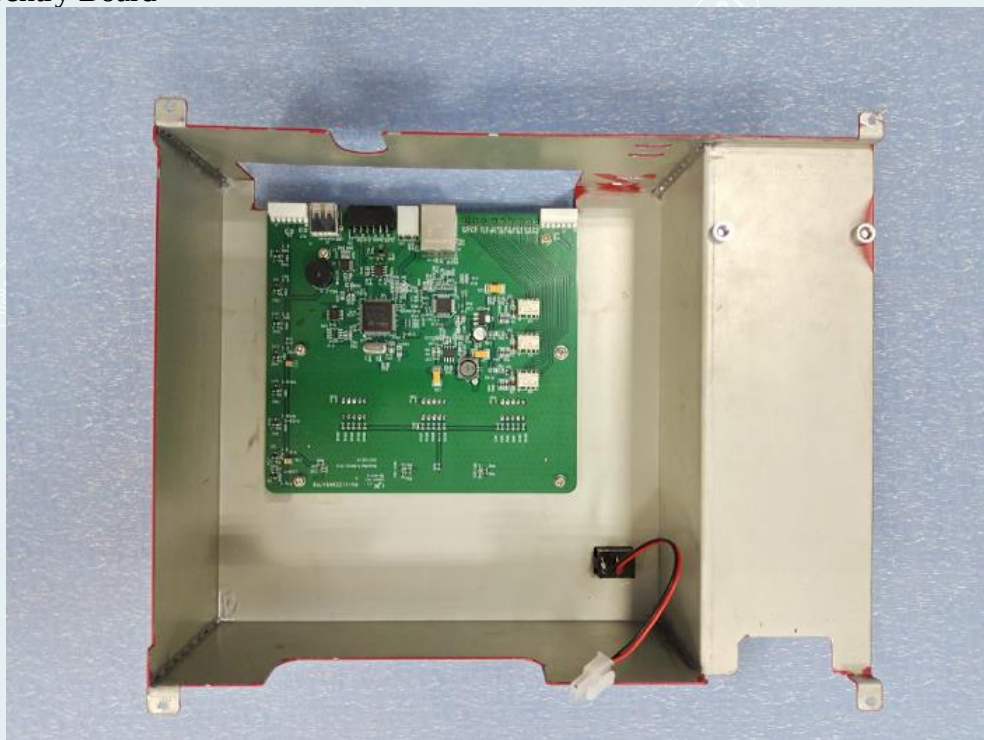


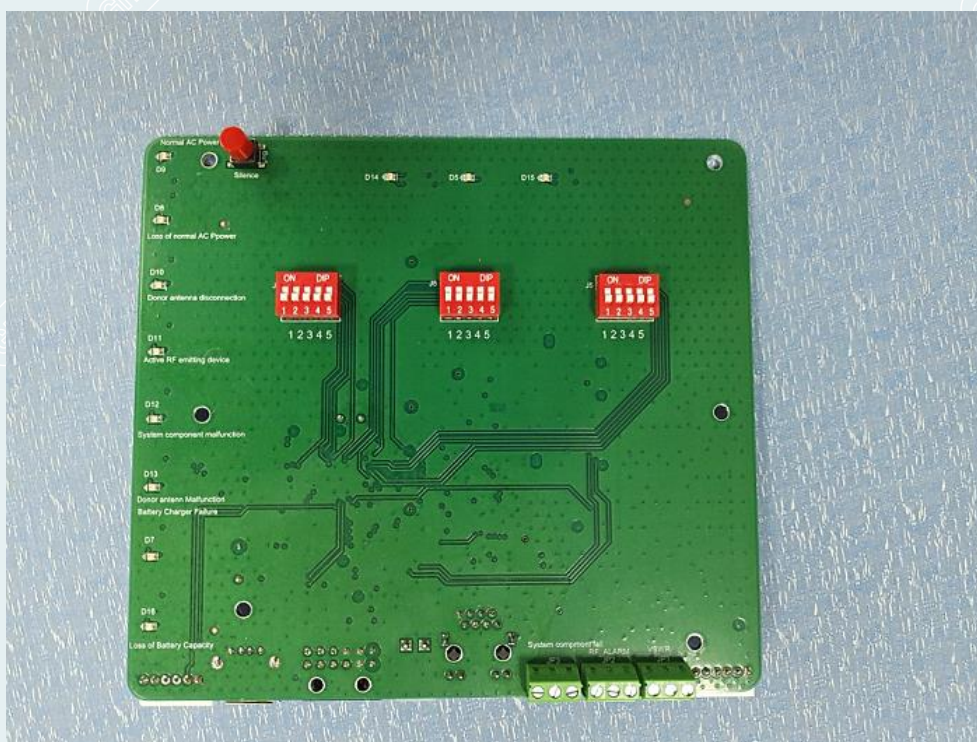
A.2.1 RF Board



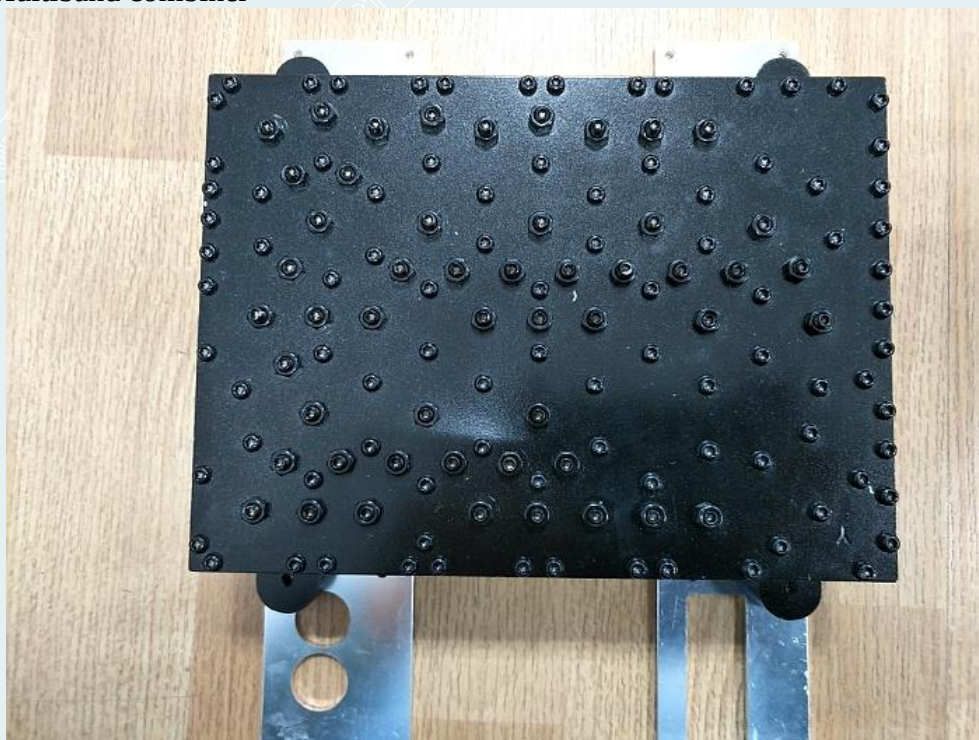


A.2.2 Sentry Board





A.2.3 Multiband combiner

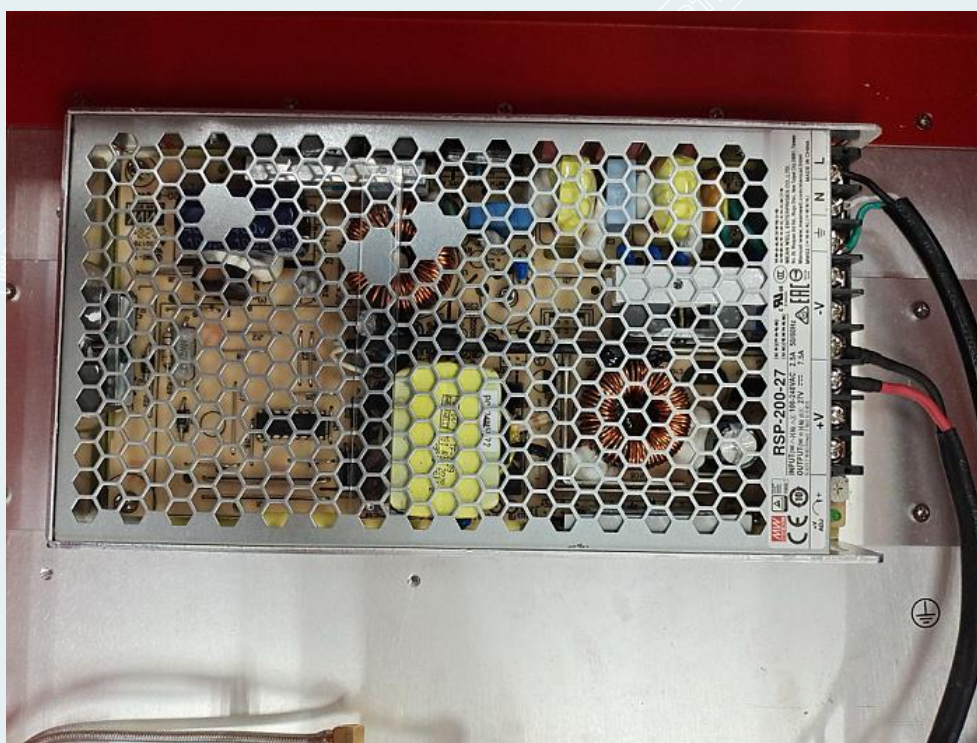


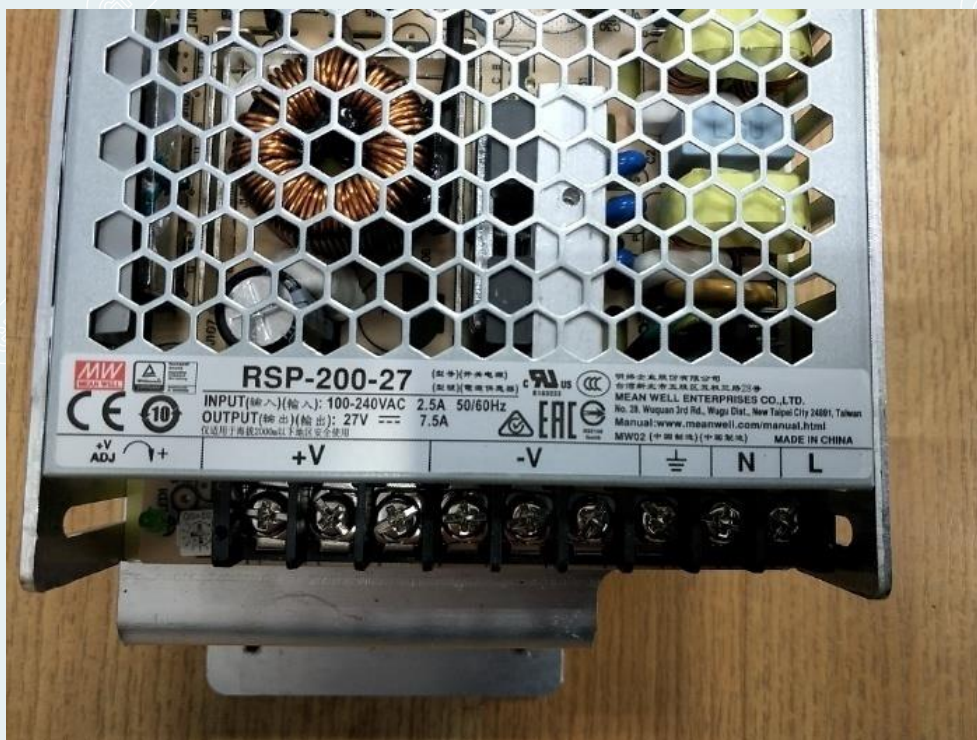
三频合路器
CH1: 758~775MHz
CH2: 788~816MHz
CH3: 851~861MHz





A.2.4 Power supply module









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