RF EXPOSURE EVALUATION REPORT

Application No.:	GZCR2409001120AT
Applicant:	Comba Telecom Network Systems Limited
Address of Applicant:	Flat/Rm 10, 3/F, Bio-Informatics Ctr, 2 Science Park West Avenue, HK Science Park, Pak Shek Kok, N.T. Hong Kong
Manufacturer:	Comba Network Systems Company Limited
Address of Manufacturer:	No. 10 Shenzhou Road, Guangzhou Science City, Guangzhou 510663, Guangdong, P.R.China
Factory:	Comba Telecom Technology (Guangzhou) Ltd.
Address of Factory:	No. 6 Jinbi Road, Economics and Technology Development District, Guangzhou, Guangdong, China
Product Name:	Public Safety UHF and VHF Dualband Bi-Directional Amplifier
Model No.:	RX14V3-B
Trade Mark:	Comba
Standard(s) :	47 CFR Part 2.1091 47 CFR Part 1.1310, Part 1.1307
Date of Receipt:	2024-09-23
Date of Evaluation:	2024-11-22
Date of Issue:	2024-11-22
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Jerry Chan
Manager

Revision Record			
Version	**Chapter**	**Date**	**Modifier Remark**
01	GZCR240900112002	2024-11-22	Original

Authorized for issue by:				
		Kevin Zhang **Kevin Zhang /Project Engineer**		
		Ricky Liu **Ricky Liu /Reviewer**		

2 Evaluation Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Requirement**	**Method**	**Result**
RF Exposure	47 CFR Part 2.1091 47 CFR Part 1.1310 47 CFR Part 1.1307	47 CFR Part 1.1310	47 CFR Part 1.1310	PASS

Note:

E.U.T./ EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

3 Contents

4 General Information

4.1 Details of E.U.T.

Power Supply:	100-240V AC, 50/60Hz	
Test Voltage:	120V AC	
Cable:	Power supply cable (4m, shielded)	
Operating Temperature:	-40 to +55 °C	
Operating Humidity:	≤95%	
Frequency Range:	VHF	Uplink: 150.05-173.4MHz Downlink: 150.05-173.4MHz
	UHF-1	Uplink: 406.1-420MHz Downlink: 406.1-420MHz
	UHF-2	Uplink: 421-430MHz Downlink: 421-430MHz
	UHF-3	Uplink: 450-512MHz Downlink: 450-512MHz
Class Type:	Class B signal booster	
Normal Output Power:	VHF	Uplink: 30dBm Downlink: 30dBm
	UHF	Uplink: 33dBm Downlink: 36dBm
Maximum Gain:	VHF	Uplink: 95dB Downlink: 95dB
	UHF	Uplink: 95dB Downlink: 95dB
Supported Modulation:	FM, P25 Phase 1, P25 Phase 2, TETRA, DMR	
Antenna Type:	External Dedicated Antenna	
Permission Antenna Gain:	0dBi or less (declared by the manufacturer)	
Software Version:	RX14_A0AV01.00	
Hardware Version:	RX14V3	
Series No.:	A1	
Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.		

4.2 Evaluated Location

All evaluation were performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663
Tel: +86 20 82155555

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.4 Deviation from Standards

None

4.5 Abnormalities from Standard Conditions

None

5 Radio Spectrum Technical Requirement

5.1 RF Exposure

5.1.1 Requirement

In accordance with 47 CFR FCC Part 2.1091, this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

According to 47 CFR FCC Part 1310, the criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in Part1.1307(b).

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f^2)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30
f = frequency in MHz. * = Plane-wave equivalent power density				

5.1.2 Method

According to IEEE C95.3:2002 section 5.5.1.1, the power density S at a point on the axis at a distance d from a transmitting antenna is given by the Friis free-space transmission formula:

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

S = power density (mW/cm²)
P = the net power delivered to the antenna (mW)
G = gain of the antenna in linear scale
d = distance between observation point and center of the radiator (cm)

From the maximum EUT RF output power, as well as the gain of the used antenna, according toe the RF power density limit stated in above table, the mimimum distance between the antenna and human body will be calculated.

5.1.3 Conclusion

For VHF DL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (30±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 32dBm= 1.59W.
4. The limit of Power Density (S) (mW/cm²)= 0.2 mW/cm²= 2.0 W/m²

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit1}) (W/m²)	Power Density (S_1) (W/m²)
1	1.59	2.0	0.13/d²

For UHF-1 DL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (36±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 38dBm= 6.31W.
4. The limit of Power Density (S) (mW/cm²)= f/1500= 0.27mW/cm²= 2.7W/m² (f=406.1MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit2}) (W/m²)	Power Density (S_2) (W/m²)
1	6.31	2.7	0.51/d²

For UHF-2 DL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (36±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 38dBm= 6.31W.
4. The limit of Power Density (S) (mW/cm^2)= f/1500= 0.28mW/cm^2= 2.8W/m^2 (f=421MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit3}) (W/m^2)	Power Density (S_3) (W/m^2)
1	6.31	2.8	$0.51/d^2$

For UHF-3 DL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (36±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 38dBm= 6.31W.
4. The limit of Power Density (S) (mW/cm^2)= f/1500= 0.30mW/cm^2= 3.0W/m^2 (f=450MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit4}) (W/m^2)	Power Density (S_4) (W/m^2)
1	6.31	3.0	$0.51/d^2$

For multiple simultaneous transmission sources, the calculated Power Density should comply with:

$(S_1/S_{limit1})+ (S_2/S_{limit2})+ (S_3/S_{limit3})+ (S_4/S_{limit4})\leq 1$

$(0.065/d^2)+(0.189/d^2)+ (0.183/d^2)+ (0.170/d^2)\leq 1$

$d \geq 0.8$

So the permitted use distance away from EUT external antenna (service antenna) is larger than 0.8 m.

For VHF UL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (30±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 32dBm= 1.59W.
4. The limit of Power Density (S) (mW/cm^2)= 0.2 mW/cm^2= 2.0 W/m^2

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit5}) (W/m^2)	Power Density (S_5) (W/m^2)
1	1.59	2.0	$0.13/d^2$

For UHF-1 UL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (33±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 35dBm= 3.17W.
4. The limit of Power Density (S) (mW/cm^2)= f/1500= 0.27mW/cm^2= 2.7W/m^2 (f=406.1MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit6}) (W/m^2)	Power Density (S_6) (W/m^2)
1	3.17	2.7	$0.26/d^2$

For UHF-2 UL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (33±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 35dBm= 3.17W.
4. The limit of Power Density (S) (mW/cm^2)= f/1500= 0.28mW/cm^2= 2.8W/m^2 (f=421MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit7}) (W/m^2)	Power Density (S_7) (W/m^2)
1	3.17	2.8	$0.26/d^2$

For UHF-3 UL

1. According to the the test report GZCR240900112001, the tested maximum conducted power was within the tune up power range (33±2dBm) and the maximum tune up power was utilized as worst case for RF exposure evaluation.
2. According to the declaration from the applicant, the permitted maximum antenna gain is 0dBi.
3. The maximum tune up tolerance power is 35dBm= 3.17W.
4. The limit of Power Density (S) (mW/cm^2)= f/1500= 0.30mW/cm^2= 3.0W/m^2 (f=450MHz for worst-case).

Maximum Antenna Gain (Numeric)	Max. tune up tolerance power (W)	Limit of Power Density (S_{limit8}) (W/m^2)	Power Density (S_8) (W/m^2)
1	3.17	3.0	0.26/d^2

For multiple simultaneous transmission sources, the calculated Power Density should comply with:

$(S_5/S_{limit5})+ (S_6/S_{limit6})+ (S_7/S_{limit7})+ (S_4/S_{limit8})\leq 1$

$(0.065/d^2)+(0.097/d^2)+ (0.093/d^2)+ (0.087/d^2)\leq 1$

$d \geq 0.6$

So the permitted use distance away from EUT external antenna (donor antenna) is larger than 0.6 m.

5.2 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2409001120AT.

- End of the Report -

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