

RF EXPOSURE EVALUATION REPORT

Application No.: GZCR2303000249AT
Applicant: Corning Optical Communications LLC
Address of Applicant: 6 Concord Road, Shrewsbury, Massachusetts, United States
Manufacturer: Comba Network Systems Company Limited
Address of Manufacturer: No.10 Shenzhou Road, Guangzhou Science City, Guangzhou 510663, Guangdong, P.R.China

Equipment Under Test (EUT):

EUT Name: Low Band dRAU
Model No.: dLRU-G2-678
Trade Mark: Corning
Standard(s) : 47 CFR Part 2.1091
47 CFR Part 1.1310, Part 1.1307
Date of Receipt: 2023-03-08
Date of Evaluation: 2023-09-08
Date of Issue: 2023-09-08

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



Ricky Liu
Manager



Revision Record			
Version	Chapter	Date	Modifier Remark
01	GZCR230300024903	2023-09-08	Original

Authorized for issue by:			
			
	Kevin Zhang /Project Engineer		
			
	Jerry Chan /Reviewer		



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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.



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4 General Information

4.1 Details of E.U.T.

Power Supply:	DC 36-57V			
Test Voltage:	DC 48V			
Cable:	N/A			
Operating Temperature:	-40 to +55 °C			
Operating Humidity:	5 to 95 %			
Frequency Range:	600MHz Service	Uplink:	663MHz to 698MHz	
		Downlink:	617MHz to 652MHz	
	Lower 700MHz	Uplink:	698MHz to 716MHz	
		Downlink:	728MHz to 746MHz	
	Upper 700MHz	Uplink:	776MHz to 787MHz	
		Downlink:	746MHz to 757MHz	
	FirstNet	Uplink:	788MHz to 798MHz	
		Downlink:	758MHz to 768MHz	
	ESMR	Uplink:	817MHz to 824MHz	
		Downlink:	862MHz to 869MHz	
	Cellular	Uplink:	824MHz to 849MHz	
		Downlink:	869MHz to 894MHz	
Radio System Type:	<input type="checkbox"/> GSM <input checked="" type="checkbox"/> WCDMA <input checked="" type="checkbox"/> LTE <input checked="" type="checkbox"/> 5G NR			
Interface:	RF Port:	2 (4.3-10-Female, ANT1~ANT2)		
	Management Port:	1 (RJ45)		
	Power Jack:	1		
	Optical Port:	1 (SFP+)		
Supported Channel Bandwidth:	GSM	<input type="checkbox"/> 200 kHz		
	WCDMA	<input checked="" type="checkbox"/> 5MHz		
	LTE	<input type="checkbox"/> 1.4 MHz	<input type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz
		<input checked="" type="checkbox"/> 10 MHz	<input checked="" type="checkbox"/> 15 MHz	<input checked="" type="checkbox"/> 20 MHz
	5G NR	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	<input checked="" type="checkbox"/> 15 MHz
		<input checked="" type="checkbox"/> 20 MHz		



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Detailed Band,technology and bandwidth :

Band	Technology	Supported Bandwidth
600MHz service	4G/5G	5/10/15/20MHz
lower 700MHz	4G/5G	5/10/15/MHz
upper 700MHz	4G/5G	5/10MHz
Firstnet	4G/5G	5/10MHz
ESMR	3G	5MHz
	4G/5G	5MHz
Cellular	3G	5MHz
	4G/5G	5/10/15/20MHz

Output Power Max. 20dBm (Downlink)

(per antenna port):

EUT MIMO property: 2X2 MIMO

ANT1 and ANT2 are MIMO port, and the internal circuit design is identical, the intend output power for antenna ports are identical.

System Gain: Max. 20dB (Downlink)

Antenna Type: External Dedicated Antenna

Permission Antenna Gain: 12.5dBi or less

Software Version: DRAUL_AV01.01.17.00

Note: 1. The EUT is a remote unit of a fiber DAS. The fiber DAS are typically comprised of three components (host unit, fiber-optic expansion unit and remote unit), which will be interconnected via fiber-optic.

The host unit connects directly to a base station via coaxial cable but cannot connect to antenna for receiving downlink and transmitting uplink, the EUT connects to antenna for transmitting downlink and receiving uplink. Therefore, only performed the test for downlink.

2. In additional, the host unit and fiber-optic expansion unit will be used as support unit for test in the report.

3. ANT1 and ANT2 are MIMO port, and the internal circuit design is identical, the intend output power for antenna ports are identical.

Therefore only performed test at antenna port 1 and record the data in this report.



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4.2 Evaluated Location

All evaluation were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

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



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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



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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 to the RF power density limit stated in above table, the minimum distance between the antenna and human body will be calculated.

5.1.3 Conclusion

For 600MHz Service band (617-652MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range (20±1dBm) 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 12.5dBi and the direction gain = G_{ANT}+10lg(N_{ANT}) dBi = 15.5dBi.
3. The maximum total tune up tolerance power is 21dBm+10lg(2)= 24.02dBm= 0.26W.
4. The limit of Power Density (S) (mW/cm²)= f/1500= 0.41 mW/cm² (f=617MHz for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S _{limit1}) (W/m ²)	Power Density (S ₁) (W/m ²)
35.481	0.26	4.1	0.74/d ²

For Lower 700MHz band (728-746MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range (20±1dBm) 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 12.5dBi and the direction gain = G_{ANT}+10lg(N_{ANT}) dBi = 15.5dBi.
3. The maximum total tune up tolerance power is 21dBm+10lg(2)= 24.02dBm= 0.26W.
4. The limit of Power Density (S) (mW/cm²)= f/1500= 0.49 (f=728MHz for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S _{limit2}) (W/m ²)	Power Density (S ₂) (W/m ²)
35.481	0.26	4.9	0.74/d ²



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For upper 700MHz band (746-757MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range ($20\pm 1\text{dBm}$) 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 12.5dBi and the direction gain = $G_{\text{ANT}} + 10\lg(N_{\text{ANT}})$ dBi = 15.5dBi.
3. The maximum total tune up tolerance power is $21\text{dBm} + 10\lg(2) = 24.02\text{dBm} = 0.26\text{W}$.
4. The limit of Power Density (S) (mW/cm^2) = $f/1500 = 0.49$ ($f=746\text{MHz}$ for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S_{limit3}) (W/m^2)	Power Density (S_3) (W/m^2)
35.481	0.26	4.9	$0.74/d^2$

For FirstNet band (758-768MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range ($20\pm 1\text{dBm}$) 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 12.5dBi and the direction gain = $G_{\text{ANT}} + 10\lg(N_{\text{ANT}})$ dBi = 15.5dBi.
3. The maximum total tune up tolerance power is $21\text{dBm} + 10\lg(2) = 24.02\text{dBm} = 0.26\text{W}$.
4. The limit of Power Density (S) (mW/cm^2) = $f/1500 = 0.51$ ($f=758\text{MHz}$ for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S_{limit4}) (W/m^2)	Power Density (S_4) (W/m^2)
35.481	0.26	5.1	$0.74/d^2$

For ESMR band (862-969MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range ($20\pm 1\text{dBm}$) 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 12.5dBi and the direction gain = $G_{\text{ANT}} + 10\lg(N_{\text{ANT}})$ dBi = 15.5dBi.
3. The maximum total tune up tolerance power is $21\text{dBm} + 10\lg(2) = 24.02\text{dBm} = 0.26\text{W}$.
4. The limit of Power Density (S) (mW/cm^2) = $f/1500 = 0.57$ ($f=862\text{MHz}$ for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S_{limit5}) (W/m^2)	Power Density (S_5) (W/m^2)
35.481	0.26	5.7	$0.74/d^2$



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For Cellular band (869-894MHz, downlink)

1. According to the the test report GZCR230300024902, the tested maximum conducted power was within the tune up power range (20±1dBm) 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 12.5dBi and the direction gain = $G_{ANT}+10\lg(N_{ANT})$ dBi = 15.5dBi.
3. The maximum total tune up tolerance power is 21dBm+10lg(2)= 24.02dBm= 0.26W.
4. The limit of Power Density (S) (mW/cm^2)= $f/1500$ = 0.58 (f=869MHz for worst-case)

Maximum Antenna Gain (Numeric)	Max. total tune up tolerance power (W)	Limit of Power Density (S _{limit6}) (W/m ²)	Power Density (S ₆) (W/m ²)
35.481	0.26	5.8	0.74/d ²

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

$$(S_1/S_{limit1})+(S_2/S_{limit2})+(S_3/S_{limit3})+(S_4/S_{limit4})+(S_5/S_{limit5})+(S_6/S_{limit6}) \leq 1$$

$$(0.181/d^2)+(0.152/d^2)+(0.152/d^2)+(0.146/d^2)+(0.130/d^2)+(0.128/d^2) \leq 1$$

$$d \geq 0.943$$

So the permitted use distance away from EUT external antenna is larger than 0.943m.



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5.2 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2303000249AT.

- End of the Report -



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