TEST REPORT

Applicant:	Cavli Inc
Address:	99 South Almaden Blvd., Suite 600, San Jose, CA, USA
Equipment Type:	LTE MODEM
Model Name:	CQS290 (refer to section 2.3)
Brand Name:	Cavli Inc
FCC ID:	2BB64CQS290
Test Standard:	47 CFR Part 2.1091 KDB 447498 D04 v01
Test Date:	Dec. 19, 2024 - Jan. 25, 2025
Date of Issue:	Jun 19, 2025

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Lining **Checked by:** Xu Rui **Approved by:** Tolan Tu

(Testing Director)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Apr 22, 2025	Initial Issue
Rev. 02	Jun 19, 2025	Update Technical Information in section2.5 and add new operation LTE Band 66. The original report is invalid.

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☑ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Cavli Inc
Address	99 South Almaden Blvd., Suite 600, San Jose, CA, USA

2.2 Manufacturer Information

Manufacturer	Cavli Inc
Address	99 South Almaden Blvd., Suite 600, San Jose, CA, USA

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	LTE MODEM
Model Name Under Test	CQS290
Series Model Name	CQS290-WW-108GNAN, CQS290-WW-108GNAH CQS290-WW-216GNAN, CQS290-WW-216GNAH CQS290-WW-232GNAN, CQS290-WW-232GNAH CQS290-WW-332GNAN, CQS290-WW-332GNAH CQS290-WW-364GNAN, CQS290-WW-364GNAH CQS290-WW-432GNAN, CQS290-WW-432GNAH CQS290-WW-464GNAN, CQS290-WW-464GNAH
Description of Model name differentiation	

Variants	GNSS	eSim
CQS290-WW-108GNAN	Yes	No
CQS290-WW-108GNAH	Yes	Yes
CQS290-WW-216GNAN	Yes	No
CQS290-WW-216GNAH	Yes	Yes
CQS290-WW-232GNAN	Yes	No
CQS290-WW-232GNAH	Yes	Yes
CQS290-WW-332GNAN	Yes	No
CQS290-WW-332GNAH	Yes	Yes
CQS290-WW-364GNAN	Yes	No
CQS290-WW-364GNAH	Yes	Yes
CQS290-WW-432GNAN	Yes	No
CQS290-WW-432GNAH	Yes	Yes
CQS290-WW-464GNAN	Yes	No
CQS290-WW-464GNAH	Yes	Yes

	(This information provided by the customer)
Hardware Version	v2.2
Software Version	N/A
Dimensions (Approx.)	L40.5mm* W:40.5mm* H:2.7mm
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	4G Network LTE FDD Band 1/2/3/4/5/7/8/12/13/18/19/20/25/26/28/66 LTE TDD Band B38/41 Bluetooth (EDR+LE) 2.4G WIFI: 802.11b,802.11g,802.11n(HT20/40) 5G WIFI: 802.11a,802.11n(HT20/40),802.11ac(VHT20/40/80) 5.8G SRD, GPS, GLONASS, BDS, Galileo

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	LTE, Bluetooth, WIFI		
Frequency Range	Bluetooth	2402 ~ 2480 MHz	
	2.4G WIFI	2412 ~ 2462 MHz	
	5G WIFI	U-NII-1: 5150 ~ 5250MHz U-NII-2A: 5250 ~ 5350MHz U-NII-2C: 5470 ~ 5725MHz U-NII-3: 5725 ~ 5850MHz	
	LTE B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	LTE B12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE B13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	LTE B18	TX: 815 ~ 824 MHz	RX: 860 ~ 869 MHz
		TX: 824 ~ 830 MHz	RX: 869 ~ 875 MHz
	LTE B19	TX: 830 ~ 845 MHz	RX: 875 ~ 890 MHz
	LTE B25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	LTE B26	TX: 814 ~ 824 MHz	RX: 859 ~ 869 MHz
		TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2200 MHz
	LTE B38	TX: 2570 ~ 2620 MHz	RX: 2570 ~ 2620 MHz
	LTE B41	TX: 2496 ~ 2690 MHz	RX: 2496 ~ 2690 MHz
Antenna Model Name	Bluetooth	PIFA	
	WIFI	PIFA	
	WWAN	PIFA	
Exposure Category	General Population/Uncontrolled Exposure		

Product Type	Mobile Device

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01

3.2 Limit Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Devices:

CFR Title 47 §2.1091(b)

For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

FCC KDB 447498 D04 General RF Exposure Guidance v01 Limit

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP20cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{\text{th}}\ (\text{mW}) = ERP_{20\,\text{cm}}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \qquad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i. e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold Pth (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by Formula (B.2).

$$P_{\text{th}}\,(\text{mW}) = \begin{cases} ERP_{20\,\text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\,\text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \qquad \text{(B.2)}$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,\text{cm}}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1).
The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

According with FCC KDB 447498 D04, Appendix A, Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.

This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

When maximum available power each individual transmitting antenna within the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm.

When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period.

5 ASSESSMENT RESULT

5.1 Output Power

Bluetooth				
Mode	GFSK	π/4-DQPSK	8-DPSK	BLE 1M
Conducted Power (dBm)	9.74	9.33	9.51	6.23
Antenna Gain (dBi)	5.00	5.00	5.00	5.00
EIRP (dBm)	14.74	14.33	14.51	11.23
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH24B0903-601 and BL-SH24B0903-602 for more details.				

WLAN					
Mode	2.4GWIFI	5GWIFI(U-NII-1)	5GWIFI(U-NII-2A)	5GWIFI(U-NII-2C)	5GWIFI(U-NII-3)
Conducted Power (dBm)	21.32	11.55	10.12	9.75	7.30
Antenna Gain (dBi)	5.00	5.00	5.00	5.00	5.00
EIRP (dBm)	26.32	16.55	15.12	14.75	12.30
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH24B0903-603 and BL-SH24B0903-604 for more details.					

	LTE												
Mode	Band 2	Band 4	Band 5	Band 7	Band 12	Band 13	Band 18	Band 19	Band 25	Band 26	Band 66	Band 38	Band 41
Conducted Power (dBm)	23.28	22.72	22.93	22.36	22.76	24.15	22.29	22.53	22.75	22.92	22.43	22.04	22.39
Antenna Gain (dBi)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
ERP/EIRP (dBm)	28.28	27.72	25.78	27.36	25.61	27.00	25.14	25.38	27.75	25.77	27.43	27.04	27.39
Note: This report listed the worst case conducted power value, please refer to RF test report No.BL-SH24B0903-501 for more details.													

5.2 Tune-up power

Mode		Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
LTE	Band 2	【22.00,24.00】	【27.00,29.00】	【24.85,26.85】
	Band 4	【22.00,24.00】	【27.00,29.00】	【24.85,26.85】
	Band 5	【22.00,24.00】	/	【24.85,26.85】
	Band 7	【21.00,23.00】	【26.00,28.00】	【23.85,25.85】
	Band 12	【22.00,24.00】	/	【24.85,26.85】
	Band 13	【23.00,25.00】	/	【25.85,27.85】
	Band 18	【21.00,23.00】	/	【23.85,25.85】
	Band 19	【22.00,24.00】	/	【24.85,26.85】
	Band 25	【22.00,24.00】	【27.00,29.00】	【24.85,26.85】
	Band 26	【22.00,24.00】	/	【24.85,26.85】
	Band 66	【22.00,24.00】	【27.00,29.00】	【24.85,26.85】
	Band 38	【21.00,23.00】	【26.00,28.00】	【23.85,25.85】
	Band 41	【21.00,23.00】	【26.00,28.00】	【23.85,25.85】
Bluetooth		【9.00,11.00】	【14.00,16.00】	【11.85,13.85】
2.4GWIFI		【20.00,22.00】	【25.00,27.00】	【22.85,24.85】
5GWIFI(U-NII-1: 5150-5250MHz)		【10.50,12.50】	【15.50,17.50】	【13.35,15.35】
5GWIFI(U-NII-2A: 5250-5350MHz)		【9.00,11.00】	【14.00,16.00】	【11.85,13.85】
5GWIFI(U-NII-2C: 5470-5725MHz)		【9.00,11.00】	【14.00,16.00】	【11.85,13.85】
5GWIFI(U-NII-3: 5725-5850MHz)		【6.00,8.00】	【11.00,13.00】	【8.85,10.85】
Note1: ERP= EIRP -2.15dB.				
Note2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth.				

5.3 RF Exposure Evaluation Result

Evolution mode		f(MHz)	Distance (cm)	Maximum power (dBm)	Maximum power (mw)	Threshold Power (mW)	P/Plimit	Verdict
LTE	Band 2	1850	20	26.85	484.17	3060.00	0.1582	Pass
	Band 4	1710	20	26.85	484.17	3060.00	0.1582	Pass
	Band 5	824	20	26.85	484.17	1680.96	0.2880	Pass
	Band 7	2500	20	25.85	384.59	3060.00	0.1257	Pass
	Band 12	699	20	26.85	484.17	1425.96	0.3395	Pass
	Band 13	777	20	27.85	609.54	1585.08	0.3845	Pass
	Band 18	815	20	25.85	384.59	1662.60	0.2313	Pass
	Band 19	830	20	26.85	484.17	1693.20	0.2859	Pass
	Band 25	1850	20	26.85	484.17	3060.00	0.1582	Pass
	Band 26	814	20	26.85	484.17	1660.56	0.2916	Pass
	Band 66	1710	20	26.85	484.17	3060.00	0.1582	Pass
	Band 38	2570	20	25.85	384.59	3060.00	0.1257	Pass
	Band 41	2496	20	25.85	384.59	3060.00	0.1257	Pass
Bluetooth		2402	20	13.85	24.27	3060.00	0.0079	Pass
WALN	2.4GWIFI	2412	20	24.85	305.49	3060.00	0.0998	Pass
	5GWIFI(U-NII-1: 5150-5250MHz)	2412	20	15.35	34.28	3060.00	0.0112	Pass
	5GWIFI(U-NII-2A: 5250-5350MHz)	5150	20	13.85	24.27	3060.00	0.0079	Pass
	5GWIFI(U-NII-2C: 5470-5725MHz)	5250	20	13.85	24.27	3060.00	0.0079	Pass
	5GWIFI(U-NII-3: 5725-5850MHz)	5470	20	10.85	12.16	3060.00	0.0040	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency(MHz)	Power /Limit	Σ(Power / Limit) of WWAN + WLAN	Verdict
LTE Band 13	777MHz ~ 787MHz	0.3845	0.4843	Pass
2.4G WIFI	2412 MHz ~ 2462 MHz	0.0998		

Note:

1. Σ(Power / Limit): This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for WWAN+ WLAN or WWAN+ Bluetooth.
2. Both of the WWAN+ WLAN can transmit simultaneously, the formula of calculated the Power is
   CP1 / LP1 + CP2 / LP2 + ……etc. < 1
   CP = Calculation power

LP = Limit of power

3. Both of the 2.4GHz WIFI and 5GHz WIFI can't transmit simultaneously at same time.
4. The worst-case situation is 0.4843, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
5. The DUT work frequency range used is 814 MHz ~ 849 MHz, 1850 MHz ~ 1915 MHz, 1710 MHz ~ 1755 MHz, 2500 MHz ~ 2570 MHz, 699 MHz ~ 716 MHz, 777 ~787 MHz, 2570 MHz ~ 2620 MHz MHz, 2535 MHz ~ 2655 MHz, 2402MHz ~ 2480 MHz, 5150MHz ~ 5250 MHz, 5250MHz ~ 5350 MHz, 5470MHz ~ 5725 MHz, 5725MHz ~ 5850 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.
6. More power list please refer to RF test report.

5.5 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
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7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--