TEST REPORT

Applicant:	Cavli Inc.
Address:	99 South Almaden Blvd., Suite 600, San Jose, CA 95113 United States
Equipment Type:	LTE MODEM
Model Name:	C16QS
Brand Name:	CAVLI WIRELESS
FCC ID:	2BB64C16QSWW
Test Standard:	47 CFR Part 2.1091 KDB 447498 D04 v01
Test Date:	Mar. 29, 2024 - Apr. 20, 2024
Date of Issue:	Jun. 14, 2024

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	Jun. 14, 2024	Initial Issue

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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 95113 United States

2.2 Manufacturer Information

Manufacturer	Cavli Inc.
Address	99 South Almaden Blvd., Suite 600, San Jose, CA 95113 United States

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	C16QS
Series Model Name	C16QS-WW-S00N,C16QS-WW-S00H,C16QS-WW-GNAN,C16QS-WW-GNAH
Description of Model name differentiation	Sub-Variants / GNSS / Internal eSim C16QS-WW-S00N / No / No C16QS-WW-S00H / No / Yes C16QS-WW-GNAN / Yes / No C16QS-WW-GNAH / Yes / Yes (This information provided by the customer, for more information, see the Difference Statement)
Hardware Version	Version 1
Software Version	v1.4.8
Dimensions (Approx.)	26.5mm x 22.5mm x 2.3mm
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	4G Network LTE FDD Band 1/2/3/4/5/7/8/12/18/19/20/25/26/28/66 LTE TDD Band 41 GPS

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

Operating Mode	WWAN

Frequency Range	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 B25	TX: 1850 ~1915 MHz	RX: 1930 ~ 1995 MHz
	LTE B66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2200 MHz
	LTE B41	TX: 2496 ~ 2690 MHz	RX: 2496 ~ 2690 MHz
	LTE B26	TX: 814 ~ 849 MHz	RX: 859 ~ 894 MHz
Antenna Type	WWAN	External Antenna	
Exposure Category	General Population/Uncontrolled Exposure		
EUT Stage	Portable Device		

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Devices:

CFR Title 47 §2.1091(b)

(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

For 300MHz to 6000Mhz

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

For 6000MHz to 10000Mhz

Frequencies above 300 kHz but at distances R > λ/2π, R is the antenna-person separation distance.
λ=wavelength of transmitted signal.
Can calculate from the frequency of operation using v=f*λ
v=speed of light=3*108 m/s
f=frequency(Hz)
Primarily an MPE-based exclusion but also SAR-based where λ/2π is < 20cm.

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES
SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 $R^2 f$
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

5 ASSESSMENT RESULT

5.1 Output Power

LTE					
Mode	Band 2	Band 4	Band 5	Band 7	Band 12
Conducted Power (dBm)	25.51	24.40	23.47	20.76	23.04
Antenna Gain (dBi)	2.50	2.50	2.50	2.50	2.50
EIRP (dBm)	28.01	26.90	23.82	23.26	23.39
Mode	Band 25	Band 26(Part22)	Band 26(Part90)	Band 66	Band 41
Conducted Power (dBm)	25.49	23.40	22.98	25.38	23.07
Antenna Gain (dBi)	2.50	2.50	2.50	2.50	2.50
EIRP (dBm)	27.99	23.75	23.33	27.88	25.57
Note: This report listed the worst case conducted power value, please refer to RF test report No.24TJ0196-501 for more details.					

5.2 Tune-up power

Mode		Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
LTE	Band 2	[24.00,26.00]	[26.50,28.50]	[24.35,26.35]
	Band 4	[23.00,25.00]	[25.50,27.50]	[23.35,25.35]
	Band 5	[22.00,24.00]	[24.50,26.50]	[22.35,24.35]
	Band 7	[19.00,21.00]	[21.50,23.50]	[19.35,21.35]
	Band 12	[21.50,23.50]	[24.00,26.00]	[21.85,23.85]
	Band 25	[24.00,26.00]	[26.50,28.50]	[24.35,26.35]
	Band 26(Part22)	[22.00,24.00]	[24.50,26.50]	[22.35,24.35]
	Band 26(Part90)	[21.50,23.50]	[24.00,26.00]	[21.85,23.85]
	Band 66	[23.50,25.50]	[26.00,28.00]	[23.85,25.85]
	Band 41	[21.50,23.50]	[24.00,26.00]	[21.85,23.85]
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

For 300MHz to 6000MHz

Evolution mode	Maximum power (dBm)	Maximum power (W)	Distance (cm)	Threshold Power (W)	Verdict
Band 2	26.35	0.4315	20	3.0600	Pass
Band 4	25.35	0.3428	20	3.0600	Pass
Band 5	24.35	0.2723	20	1.6810	Pass
Band 7	21.35	0.1365	20	3.0600	Pass
Band 12	23.85	0.2427	20	1.4260	Pass
Band 25	26.35	0.4315	20	1.6810	Pass
Band 26(Part22)	24.35	0.2723	20	1.6606	Pass
Band 26(Part90)	23.85	0.2427	20	3.0600	Pass
Band 66	25.85	0.3846	20	3.0600	Pass
Band 41	23.85	0.2427	20	3.0600	Pass

Note:

1. More power list please refer to 24TJ0196-501 test report.

5.4 Conclusion

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

Statement

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--END OF REPORT--