Test report no.: *Prüfbericht-Nr.:*	**CN23L252 004**	**Order No.:** *Auftragsnr.:*	168426958	**Page 1 of 11** *Seite 1 von 11*
Client reference no.: *Kunden-Referenz-Nr.:*	N/A	**Order date:** *Auftragsdatum:*	2023-05-16	
Client: *Auftraggeber:*	Guangzhou Lango Electronics Technology Co., Ltd. 15/F, Building B1, NO.11, Guangpu Road, Huangpu District, Guangzhou, Guangdong, P.R. China			
Test item: *Prüfgegenstand:*	OPS-8195A			
Identification / Type no.: *Bezeichnung / Typ-Nr.:*	OPS-8195A-4R64S, OPS-8195A-8R128S, OPS-8195A-16R256S			
Order content: *Auftrags-Inhalt*:	Test Report			
Test specification *Prüfgrundlage:*	47 CFR FCC Part 2.1091 RSS-102 Issue 5			

Date of sample receipt: *Wareneingangsdatum:*	2023-05-20	Please refer to Photo Document
Test sample no: *Prüfmuster-Nr.:*	A003490153 001~003 A003473530-001,003 A003473530-006~007	
Testing period: *Prüfzeitraum:*	2023-05-21 to 2023-06-24	
Place of testing: *Ort der Prüfung:*	Refer to section 2.1	
Testing laboratory: *Prüflaboratorium:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Test result*: *Prüfergebnis*:*	Pass	

tested by: *geprüft von:*	x Bell Hu Signed by: Bell Hu	**authorized by:** *genehmigt von:*	X Lin Lin Signed by: Lin Lin
Date: 2023-07-13 *Datum:*		**Issue date:** 2023-07-13 *Ausstellungsdatum:*	
Position / *Stellung*:	Expert/Sachverständige(r)	**Position** / *Stellung*:	Expert/Sachverständige(r)

Other:
Sonstiges:
FCC ID: 2BA840001
IC: 21669-0001
HVIN: OPS-8195A-4R64S, OPS-8195A-8R128S, OPS-8195A-16R256S

Condition of the test item at delivery:
Zustand des Prüfgegenstandes bei Anlieferung:
Test item complete and undamaged
Prüfmuster vollständig und unbeschädigt

* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet

This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
V05

Remarks
Anmerkungen

1	The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request. *Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.* *Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.*
2	As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged. *Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben.*
3	Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report. *Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.*
4	The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019. *Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.*

TEST SUMMARY

3.1.1 RF EXPOSURE COMPLIANCE

RESULT: *Pass*

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1. TEST SITES

1.1 TEST FACILITIES

TÜV Rheinland (Shenzhen) Co., Ltd.

Address: No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China

FCC Registration No.: 694916

ISED wireless device testing laboratory: 25069

1.2 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

1.3 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

1.4 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendixes of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

1.5 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. facility located at No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

2. GENERAL PRODUCT INFORMATION

2.1 GENERAL DESCRIPTION

The EUT is an OPS-8195A, which supports Bluetooth(dual mode), 2.4GHz Wi-Fi 802.11 b/g/n/ax and 5GHz Wi-Fi 802.11a/n/ac/ax wireless technology.

For details refer to the User Manual, Technical Description and Circuit Diagram.

2.2 RATING AND SYSTEM DETAILS

Table 1: Technical Specification of EUT

General Information of EUT	**Value**
Kind of Equipment:	OPS-8195A
Type Designation:	OPS-8195A-4R64S, OPS-8195A-8R128S, OPS-8195A-16R256S
FCC ID:	2BA840001
IC ID:	21669-0001
PMN:	OPS-8195A
HVIN:	OPS-8195A-4R64S, OPS-8195A-8R128S, OPS-8195A-16R256S
Operating Voltage:	12V ~ 19V DC input via panel JAE port
Testing Voltage:	AC 120V, 60Hz
Technical Specification of Bluetooth (dual mode)	
Operating Frequency:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK, π/4-DQPSK, 8DPSK
Channel Number:	BDR & EDR mode:79 channels; Low Energy mode:40 channels
Channel Separation:	BDR & EDR mode: 1MHz, 2MHz; Low Energy mode: 2MHz
Data Rate:	BDR & EDR mode: 1Mbps, 2Mbps, 3Mbps Low Energy mode: 1Mbps, 2Mbps
Antenna Type:	External Antenna
Antenna Gain of Bluetooth:	5.0 dBi Max(As detailed in Antenna spec)
Technical Specification of Wi-Fi 802.11 b/g/n/ax	
Operating Frequency:	2412 - 2462 MHz for 802.11b/g/n(HT20)/ax(HE20) 2422 - 2452 MHz for 802.11n(HT40)/ax(HE40)
Type of Modulation:	802.11b: CCK, DQPSK, DBPSK 802.11g/n : BPSK, QPSK, 16QAM, 64QAM 802.11ax: BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
Data Rate:	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0~MCS 7 for 802.11n(HT20/40) MCS0~MCS11 for 802.11ax(HE20/40) (All data rates considered, only the Worst-cases reported)
Channel Number:	11 channels for 802.11b/g/n(HT20)/ax(HE20) 7 channels for 802.11n(HT40)/ax(HE40)

Channel Separation:	5 MHz
Antenna Type:	External Antenna
Number of Antenna:	2
Antenna Gain:	5.0 dBi Max(As detailed in Antenna spec)
Note: WLAN 2.4GHz 802.11n and 802.11ax support. For directional gain: Array Gain = 10 log(*NANT/NSS*) dB. So the Directional gain =GANT + 10 log(NANT) dBi (The worst case directional gain will occur when NSS = 1).	
Technical Specification of Wi-Fi 802.11 a/n/ac/ax	
Operating Frequency:	5180-5320MHz, 5500-5720MHz, 5745-5825MHz
Type of Modulation:	802.11n/a: BPSK, QPSK, 16QAM, 64QAM 802.11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM 802.11ax: BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
Protocol:	802.11 a/n20/n40/ac20/ac40/ac80/ ax20/ax40/ax80
Data Rate:	6/9/12/18/24/36/48/54 Mbps for 802.11a MCS0~MCS7 for 802.11n MCS0~MCS9 for 802.11ac MCS0~MCS11 for 802.11ax (All data rates considered, only the Worst-cases reported)
Channel Separation	5 MHz
Antenna Type:	External Antenna
Number of Antenna:	2
Antenna Gain:	5.0 dBi Max (As detailed in Antenna spec)
Type of Device	Slave Device without Radar Detection
Note: WLAN 5GHz 802.11n/802.11ac/802.11ax. For directional gain: Array Gain = 10 log(*NANT/NSS*) dB. So the Directional gain =GANT + 10 log(NANT) dBi (The worst case directional gain will occur when NSS = 1).	

Note: all required modes considered, and only the worst-case reported.
* All the models share the same circuit design and PCB layout, the different in RAM and ROM.

Model number	**RAM and ROM configuration**
OPS-8195A-4R64S	4GB/64GB
OPS-8195A-8R128S	8GB/128GB
OPS-8195A-16R256S	16GB/256GB

3. Test Results

3.1 Transmitter Requirements & Test Suites

3.1.1 RF Exposure Compliance

RESULT: **Pass**

Test standard	:	RSS-102 Issue 5 FCC Part 1.1091 KDB 447498 D01 General RF Exposure Guidance v06
Limit	:	Table 1 of 47 CFR FCC Part 1.1310 Section 2.5.2 of RSS-102 Issue 5
Kind of test site	:	Shielded room

This device is mobile device, and the applicant declares that the minimum separation distance is greater than 20cm. Therefore MPE measurement or computational modelling should be used to determine compliance.

MPE Calculation is based on the conducted power, and considering maximum power and Antenna gain. The following formula is used to MPE evaluation.

$$Pd = \frac{Pout * G}{4R^2\pi}$$

Where
P_d = power density in mW/cm^2 or W/m^2
P_{out} = output power to antenna in mW or W
G_{num} = Antenna gain in numeric
π = 3.14159
R = Distance between observation point and the center of radiator in cm or m

3.1.1.1 FCC Part 1.1310, Part 2.1091

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

Table 2: Test Results of RF Exposure Calculations for FCC, stand-alone mode

Operating Mode	Max. EIRP incl. tune-up (dBm)	Distance (cm)	MPE P_d (mW/cm^2)	Limit (mW/cm^2)	Verdict
Bluetooth	12.5	20	0.0035	1.0	Pass
2.4G Wi-Fi	26.5	20	0.0889	1.0	Pass
5G Wi-Fi	27.5	20	0.1119	1.0	Pass

1. RF Output Power above: Refer to test report CN23HQZY 001~003.
2. EIRP= Average Conducted power +Directional Gain

Table 3: Test Results of RF Exposure Calculations for FCC, Simultaneous mode

Operating Mode (Worst-Case)	Sum of the MPE ratios for all simultaneously	Limit	Verdict
Bluetooth+5G Wi-Fi	0.116, far less than limit	1.0	Pass

Note: Simultaneous mode only supported for BLE +Wi-Fi.

3.1.1.2 RSS-102 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

• below 20 MHz6 and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 4.49/f0.5 W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Table 4: Test Results of RF Exposure Calculations for ISED, Stand-alone mode

Operating Mode	Max. EIRP incl. tune-up (dBm)	Distance (cm)	Maximum EIRP (W)	Threshold power (W)	Verdict
Bluetooth	12.5	20	0.018	2.68	Pass
2.4G Wi-Fi	26.5	20	0.447	2.70	Pass
5G Wi-Fi	27.5	20	0.562	4.90	Pass
Note: The maximum EIRP lower than the threshold power in section 2.5.2, thus compliant.					

1. RF Output Power above: Refer to test report CN23HQZY 001~003.
2. EIRP= Average Conducted power +Directional Gain

Table 5: Test Results of RF Exposure Calculations for ISED, Simultaneous mode

Operating Mode(Worst-Case)	Sum of the ratios	Limit	Verdict
BLE+2.4G Wi-Fi	0.018/2.68+0.562/2.7,far less than 1.0	1.0	Pass

Note: Simultaneous mode only supported for BLE +Wi-Fi.

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