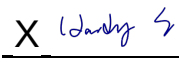


Prüfbericht-Nr.: <i>Test report no.:</i>	CN23QG53 003	Auftrags-Nr.: <i>Order no.:</i>	168428354 P01070601	Seite 1 von 15 <i>Page 1 of 15</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-05-25	
Auftraggeber: <i>Client:</i>	ELSYS EQUIPAMENTOS ELETRONICOS LTD RUA DOUTOR ALCIDES GOMES MIRANDA, 251, Valinhos, Brazil			
Prüfgegenstand: <i>Test item:</i>	Amplimax Ultra			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	EPRL30			
Auftrags-Inhalt: <i>Order content:</i>	Test Report			
Prüfgrundlage: <i>Test specification:</i>	47 CFR FCC Part 2.1091 447498 D01 General RF Exposure Guidance v06			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-08-17			
Prüfmuster-Nr.: <i>Test sample no:</i>	A003541536-003			
Prüfzeitraum: <i>Testing period:</i>	2023-09-07 – 2024-01-31			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	 Hardy Suo		genehmigt von: <i>authorized by:</i>	 Lin Lin
Datum: <i>Date:</i>	2024-04-07		Ausstellungsdatum: <i>Issue date:</i>	2024-04-07
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position:	Sachverständige(r)/Expert
Sonstiges / Other:	FCC ID:2AZC5-02			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * 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				
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. <i>This test report only relates to the a. m. 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.</i>				

V05

Anmerkungen

Remarks

- | | |
|----------|---|
| 1 | <p>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.</p> <p>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</p> <p><i>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.</i></p> <p><i>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</i></p> |
| 2 | <p>As contractually agreed, this document has been signed digitally only. TÜV 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, TÜV 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.</p> <p><i>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.</i></p> |
| 3 | <p>Test clauses with remark of * are subcontracted to qualified subcontractors and described 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.</p> <p><i>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.</i></p> |
| 4 | <p>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.</p> <p><i>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen 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.</i></p> |

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TEST SUMMARY

5.1.1 RF EXPOSURE COMPLIANCE

RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix: N/A

2. Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China.

FCC Accreditation Designation No.: CN1260 FCC Registration No.: 694916

ISED Wireless Device Testing Laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Signal Analyzer	R&S	FSV 40	101440	2024-08-05
Wideband Radio Communication Tester	R&S	CMW500	165339	2024-07-25

2.3 Traceability

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

2.4 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 basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table:

Items		Extended Uncertainty
Radio Spectrum	Output Power (dBm)	U=0.5dB, k=2, σ =95%

2.6 Location of Original Data

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

2.7 Status of Facility Used for Testing

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

3. General Product Information

3.1 Product Function and Intended Use

The EUT is outdoor CPE with embedded directional antenna for fixed wireless access used for internet access. It transmits data over 4G and 5G cellular network. It supports Bluetooth and Wi-Fi wireless function.

The pre-certified Bluetooth and Wi-Fi modules were integrated into EUT.

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

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment:	Amplimax Ultra
Type Designation:	EPRL30
FCC ID:	2AZC5-02
Type of Equipment:	End device
Antenna Type:	Integrated Antenna
Operating Voltage:	DC 24V via AC/DC power supply or PoE supply
Technical Specification of Bluetooth and Wi-Fi	
Operated Modes:	Bluetooth Classic Mode, Bluetooth Low Energy Wi-Fi 2.4GHz Band
Certified Transmitter Module:	Integrated module (FCC ID: 2AC7Z-ESP32MINII)
Operational Frequency Band(s):	2402 – 2480 MHz for Bluetooth 2412 – 2462 MHz for Wi-Fi
Max. RF output power (Conducted):	11.86 dBm for Bluetooth Classic Mode 16.52 dBm for Wi-Fi 2.4GHz band 7.98 dBm for Bluetooth Low Energy
Channel Number:	79 channels for Bluetooth Classic Mode 11 channels for Wi-Fi 2.4GHz band 802.11b/g/n(HT20) 7 channels for Wi-Fi 2.4GHz band 802.11n(HT40) 40 channels for Bluetooth Low Energy
Channel Bandwidth:	1MHz & 2 MHz for Bluetooth 20 MHz & 40 MHz for Wi-Fi 2.4GHz
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Antenna Type:	Integrated Antenna, IPEX antenna
Antenna Gain:	2.33 dBi (declared by the manufacturer)
Technical Specification of Cellular Network	
Operated Modes:	LTE and NR

Certified Transmitter Module:	Integrated module (FCC ID:XMR2022RG520NNA)
Operational Frequency Band(s):	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 29, 30, 38, 41, 48, 66, 71 NR Band n2, n5, n7, n12, n14, n25, n26, n30, n38, n41, n48, n66, n71, n77, n78
Rated RF output power (Conducted):	LTE Power Class 3: +23 dBm $\pm$ 2 dB (except band 48) NR Power Class 3: +23 dBm $\pm$ 2 dB (except band n48) NR Power Class 2: +26 dBm $\pm$ 2 dB (only for Band n38 and n41) NR Power Class 2: +24 dBm $\pm$ 2 dB (only for Band n77 and n78) LTE Band 48 / NR Band n48: 16 dBm $\pm$ 1 dB
Channel Bandwidth:	E-UTRA Band Band 2, Band 4, Band 5, Band 25 Band 26, Band 66: 1.4, 3, 5, 10, 15, 20 MHz Band 7, Band 38, Band 41, Band 48, Band 71: 5, 10, 15, 20 MHz Band 12: 1.4, 3, 5, 10 MHz Band 13, Band 14, Band 17, Band 30: 5, 10 MHz NR Band n2, n5, n26, n71: 5, 10, 15, 20MHz n7, n25: 5, 10, 15, 20, 25, 30, 40MHz n66: 5, 10, 15, 20, 30, 40MHz n12: 5, 10, 15MHz n14: 5, 10MHz n38: 10, 15, 20, 30, 40MHz n41: 20, 30, 40, 50, 60, 70, 80, 90, 100MHz n48: 10, 20, 30, 40 MHz n77, n78: 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100MHz
Modulation Type:	QPSK, 16QAM, 64QAM, 256QAM
Antenna Type:	Integrated Antenna, directional antenna
Antenna Gain:	Max. 7 dBi (Provided by the Client)

3.3 Independent Operation Modes

The basic operation modes are:

- A. NR mode
- B. LTE mode
- C. Bluetooth mode
- D. Wi-Fi mode
- E. Standby
- F. Off

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3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material	- Circuit Diagram
- PCB Layout	- Instruction Manual
- Photo Document	- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5.

4.3 Special Accessories and Auxiliary Equipment

Table 3: List of Accessories and Auxiliary Equipment

Name	Model	Manufacturer	S/N
Switching Power Supply	S024AMU2400100	TEN PAO INDUSTRIAL CO LTD.	N/A
PoE Adapter	Amplimax Ultra POE adapter	ELSYS	N/A

4.4 Countermeasures to achieve EMC Compliance

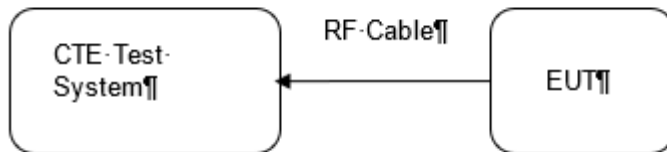
The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Equipment Configuration for Transmitter Measurement

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5. Test Results

5.1 RF Exposure Requirements & Test Suites

5.1.1 RF Exposure Compliance

RESULT: Pass

Test date	:	2023-09-07 to 2024-01-31
Test standard	:	47 CFR FCC Part 2.1091
Reference	:	KDB 447498 D01 General RF Exposure Guidance v06
Limit	:	Table 1 of 47 CFR FCC Part 1.1310
Kind of test site	:	Shielded room

TEST SETUP

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A, B
Ambient temperature	:	23 °C
Relative humidity	:	49%
Atmospheric pressure	:	101.0 kPa

This device is mobile device, and the applicant declares that the minimum separation distance is greater than 50 cm. 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.

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

Where

P_d = power density in mW/cm² or W/m²

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

Note: The NR and LTE modes cannot transmit simultaneous.

FCC MPE Result for Bluetooth and Wi-Fi operation

Operating Mode	Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Input Power of the antenna P (mW)	Min. Distance (cm)	Calculation (mW/cm ²)	FCC Limit (mW/cm ²)	Result
Bluetooth Classic Mode	11.86	2.33	15.35	50	0.0008	1.0	PASS
Bluetooth Low Energy	7.98	2.33	6.28	50	0.0003	1.0	PASS
Wi-Fi 2.4GHz	16.54	2.33	45.08	50	0.0025	1.0	PASS

FCC MPE Result for LTE operation

Operating Mode	Maximum Conducted Output Power	Antenna Gain (dBi)	Input Power of the antenna P (mW)	Min. Distance (cm)	Calculation (mW/cm ²)	FCC Limit (mW/cm ²)	Result
	Max. Power incl. tune-up (dBm)						
Band 2, LTE	25.00	7.00	316.23	50	0.05	1	PASS
Band 4, LTE	25.00	5.00	316.23	50	0.03	1	PASS
Band 5, LTE	25.00	7.00	316.23	50	0.05	0.55	PASS
Band 7, LTE	25.00	7.00	316.23	50	0.05	1	PASS
Band 12, LTE	25.00	6.00	316.23	50	0.04	0.47	PASS
Band 13, LTE	25.00	6.00	316.23	50	0.04	0.52	PASS
Band 14, LTE	25.00	6.00	316.23	50	0.04	0.53	PASS
Band 17, LTE	25.00	6.00	316.23	50	0.04	0.47	PASS
Band 25, LTE	25.00	7.00	316.23	50	0.05	1	PASS
Band 26, LTE	25.00	7.00	316.23	50	0.05	0.54	PASS
Band 30, LTE	25.00	7.00	316.23	50	0.05	1	PASS
Band 38, LTE	25.00	5.00	316.23	50	0.03	1	PASS
Band 41, LTE	25.00	5.00	316.23	50	0.03	1	PASS
Band 48, LTE	17.00	6.00	50.12	50	0.01	1	PASS
Band 66, LTE	25.00	5.00	316.23	50	0.03	1	PASS
Band 71, LTE	25.00	6.00	316.23	50	0.04	0.44	PASS

FCC MPE Result for NR operation

Operating Mode	Maximum Conducted Output Power	Antenna Gain (dBi)	Input Power of the antenna P (mW)	Min. Distance (cm)	Calculation (mW/cm ²)	FCC Limit (mW/cm ²)	Result
	Max. Power incl. tune-up (dBm)						
Band 2, NR	25.00	7.00	316.23	50	0.05	1	PASS
Band 5, NR	25.00	7.00	316.23	50	0.05	1	PASS
Band 7, NR	25.00	7.00	316.23	50	0.05	1	PASS
Band 12, NR	25.00	6.00	316.23	50	0.04	0.47	PASS
Band 14, NR	25.00	6.00	316.23	50	0.04	0.53	PASS
Band 25, NR	25.00	7.00	316.23	50	0.05	1	PASS
Band 26, NR	25.00	7.00	316.23	50	0.05	0.54	PASS
Band 30, NR	25.00	7.00	316.23	50	0.05	1	PASS
Band 38, NR	25.00	5.00	316.23	50	0.03	1	PASS
Band 41, NR	25.00	5.00	316.23	50	0.03	1	PASS
Band 48, NR	17.00	6.00	50.12	50	0.01	1	PASS
Band 66, NR	25.00	5.00	316.23	50	0.03	1	PASS
Band 71, NR	25.00	6.00	316.23	50	0.04	0.44	PASS
Band 77, NR	26.00	6.00	398.11	50	0.05	1	PASS
Band 78, NR	26.00	6.00	398.11	50	0.05	1	PASS

Evaluation Results of Simultaneous Transmission for FCC

Scenario #	Combination of RF Sources		$\frac{Pd_1}{Pd_{Limit,1}}$	$\frac{Pd_2}{Pd_{Limit,2}}$	$\sum_i \frac{Pd_i}{Pd_{Limit,i}}$	Limit	Result
	Source 1	Source 2					
A	Bluetooth	LTE	0.0008	0.0926	0.0934	1	Pass
B	Wi-Fi	LTE	0.0025	0.0926	0.0951	1	Pass
C	Bluetooth	NR	0.0008	0.0926	0.0934	1	Pass
D	Wi-Fi	NR	0.0025	0.0926	0.0951	1	Pass

Note:

1. The results are evaluated on the maximum evaluation result of power density (Pd).

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