

Prüfbericht-Nr.: <i>Test report no.:</i>	CN228D5M 002	Auftrags-Nr.: <i>Order no.:</i>	168345209	Seite 1 von 09 Page 1 of 09
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-11-26	
Auftraggeber: <i>Client:</i>	Hangzhou Zhiyuan Electronic Co., Ltd No.10, Naxian Street, Dalu Industrial Park, 311113 Hangzhou City, Zhejiang, P.R. China			
Prüfgegenstand: <i>Test item:</i>	Module: LTE module HOST: TBOX			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	Module: AG35-NA HOST: EV2-G			
Auftrags-Inhalt: <i>Order content:</i>	EMF Report			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 2: Section 2.1091 CFR47 FCC Part 1: Section 1.1310 FCC KDB Publication 447498 v06, section 7 RSS-102 Issue 5 March 2015			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-11-26	Please refer to Photo Document		
Prüfmuster-Nr.: <i>Test sample no.:</i>	N/A			
Prüfzeitraum: <i>Testing period:</i>	N/A			
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>	Jonath an Li		genehmigt von: <i>authorized by:</i>	
Datum: <i>Date:</i>	2022-01-20		Ausstellungsdatum: <i>Issue date:</i>	2022-01-20
Stellung / Position:	Sachverständige(r) / Expert		Stellung / Position:	Sachverständige(r) / Expert
Sonstiges / Other:	FCC ID: 2A3ZB-EV2G Contains FCC ID: XMR201905AG35NA IC: 28083-EV2G Contains IC: 10224A-2019AG35NA HVIN: EV2G			
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:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
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>				

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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.

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

CNAS accreditation certification number: L3080

A2LA accreditation certification number: 5162.01

3. GENERAL PRODUCT INFORMATION

3.1 GENERAL DESCRIPTION

EV2-G is a 4G version of intelligent central control terminal which is installed on the vehicles. It provides remote communication interface for the whole vehicle, and can provide services such as driving data acquisition, driving track recording, vehicle positioning (GPS, Beidou), vehicle fault monitoring, BLE communication.

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

3.2 TECHNICAL DATA

Table 1: Rating of EUT

General Information of EUT	Description
Kind of Equipment:	TBOX
Type Designation:	EV2-G
Trade Mark:	
Application of Equipment:	Combined Radio Equipment
Operating Voltage:	DC 12V
Operating Temperature Range:	-40°C ~ +60°C

Table 2: Technical Specification of EUT

Wireless Access			
GSM	850, 1900		
WCDMA Note 1	Band II, Band IV,Band V		
LTE Note 1	Band 2, Band 4, Band 5, Band 7, Band 12, Band 13, Band 17		
Note 1: The certified module(AG35-NA) Integrated in the device have been granted by FCC ID: XMR201905AG35NA, IC: 10224A-2019AG35NA.			
Antenna informatton:			
Operation Mode	Antenna type	Antenna Gain (dBi)	Remark
Bluetooth(BLE)	PCB antenna	0	
GSM 850	PIFA	-0.35	Changed antenna
DCS1900	PIFA	1.68	Changed antenna
WCDMA Band II	PIFA	1.61	Changed antenna

WCDMA Band VI	PIFA	2.51	Changed antenna
WCDMA Band V	PIFA	-3.47	Changed antenna
LTE Band 2	PIFA	1.61	Changed antenna
LTE Band 4	PIFA	2.51	Changed antenna
LTE Band 5	PIFA	-3.47	Changed antenna
LTE Band 7	PIFA	5.14	Changed antenna
LTE Band 12	PIFA	-0.28	Changed antenna
LTE Band 13	PIFA	-2.92	Changed antenna
LTE Band 17	PIFA	-0.28	Changed antenna

Table 3: GSM/PCS Operating Frequency Range and Channel Bandwidth

Frequency Band(s)	Frequency Range		Channel Bandwidth (MHz)
	Transmitting f_{UL} (MHz)	Receiving f_{DL} (MHz)	
GSM850	824 ~ 850	869 ~ 894	0.2
PCS1900	1850 ~ 1910	1930 ~ 1990	0.2

Table 4: WCDMA Operating Frequency Range and Channel Bandwidth

Frequency Band(s)	Frequency Range		Channel Bandwidth (MHz)
	Transmitting f_{UL} (MHz)	Receiving f_{DL} (MHz)	
Band II	1850 ~ 1910	1930 ~ 1980	5
Band IV	1710 ~ 1755	2110 ~ 2155	5
Band V	824 ~ 849	869 ~ 894	5

Table 5: LTE Operating Frequency Range and Channel Bandwidth

Frequency Band(s)	Frequency Range		Channel Bandwidth (MHz)
	Transmitting f_{UL} (MHz)	Receiving f_{DL} (MHz)	
Band 2	1850 ~ 1910	1930 ~ 1980	1.4, 3, 5, 10, 15, 20
Band 4	1710 ~ 1755	2110 ~ 2155	1.4, 3, 5, 10, 15, 20
Band 5	824 ~ 849	869 ~ 894	1.4, 3, 5, 10
Band 7	2500 ~ 2570	2620 ~ 2690	5, 10, 15, 20
Band 12	699 ~ 716	729 ~ 746	1.4, 3, 5, 10
Band 13	777 ~ 787	746 ~ 756	5, 10
Band 17	704 ~ 716	734 ~ 746	5, 10

Table 6: RF Channel and Frequency of Bluetooth Low Energy

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
00	2402.00	10	2422.00	20	2442.00	30	2462.00
01	2404.00	11	2424.00	21	2444.00	31	2464.00
02	2406.00	12	2426.00	22	2446.00	32	2466.00
03	2408.00	13	2428.00	23	2448.00	33	2468.00
04	2410.00	14	2430.00	24	2450.00	34	2470.00
05	2412.00	15	2432.00	25	2452.00	35	2472.00

06	2414.00	16	2434.00	26	2454.00	36	2474.00
07	2416.00	17	2436.00	27	2456.00	37	2476.00
08	2418.00	18	2438.00	28	2458.00	38	2478.00
09	2420.00	19	2440.00	29	2460.00	39	2480.00

3.3 INDEPENDENT OPERATION MODES

The basic operation modes are:

- A. On, Transmitting

3.4 NOISE GENERATING AND NOISE SUPPRESSING PARTS

Refer to the Circuit Diagram.

3.5 SUBMITTED DOCUMENTS

- | | |
|---|--|
| ☒ User Manual | ☒ Rating Label |
| ☒ Circuit Diagram | ☒ PCB Layout |
| ☒ Block Diagram | ☒ Photo Document |
| ☒ Schematics | ☒ Parts List |
| ☒ Model Difference Letter | |

4. TEST SET-UP AND OPERATION MODES

4.1 PRINCIPLE OF CONFIGURATION SELECTION

N/A

4.2 TEST OPERATION AND TEST SOFTWARE

N/A

4.3 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.

5. TEST RESULTS

1. Safety Human Exposure

a. Radio Frequency Exposure Compliance

i. Electromagnetic Fields

RESULT:

Pass

Test Specification

Test standard : CFR47 FCC Part 2: Section 2.1091
CFR47 FCC Part 1: Section 1.1310
FCC KDB Publication 447498 v06, section 7
RSS-102 Issue 5 March 2015

➤ FCC requirements

FCC requirement: Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 20cm normally can be maintained between the user and the device.

Below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields according to FCC Part 1.1310.

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				
0.3-3.0	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

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating

configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency.

MPE Calculation Method according to KDB 447498 v06

Power Density: $S_{(mW/cm^2)} = PG/4\pi R^2$ or $EIRP/4\pi R^2$

Where:

S = power density (mW/cm²)

P = power input to the antenna (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm)

➤ **IC requirements:** The EUT shall comply with the requirement of RSS-102.

Exemption from Routine Evaluation Limits – 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 MHz 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 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 $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

a) EUT RF Exposure Evaluation standalone operations

FCC RF Exposure Evaluation

Test Mode	Maximum Output Power		Antenna Gain (dBi)	Maximum e.i.r.p		$S_{(mW/cm^2)} = \frac{PG}{4\pi R^2}$	Limit (mW/cm ²)
	(dBm)	(mW)		(dBm)	(mW)		
Bluetooth(BLE)	-3.31	0.47	0	-3.31	0.47	0.00	1.000
GSM850	25.84	383.71	-0.35	25.49	354.00	0.07	0.549
PCS1900	23.84	242.10	1.68	25.52	356.45	0.07	1.000
WCDMA Band II	25.0	316.23	1.61	26.61	458.14	0.09	1.000
WCDMA Band VI	25.0	316.23	2.51	27.51	563.64	0.11	1.000
WCDMA Band V	25.0	316.23	-3.47	21.53	142.23	0.03	0.550
LTE Band 2	25.0	316.23	1.61	26.61	458.14	0.09	1.000
LTE Band 4	25.0	316.23	2.51	27.51	563.64	0.11	1.000
LTE Band 5	25.0	316.23	-3.47	21.53	142.23	0.03	0.550
LTE Band 7	25.0	316.23	5.14	30.14	1032.76	0.21	1.000
LTE Band 12	25.0	316.23	-0.28	24.72	296.48	0.06	0.470
LTE Band 13	25.0	316.23	-2.92	22.08	161.44	0.03	0.520
LTE Band 17	25.0	316.23	-0.28	24.72	296.48	0.06	0.469

IC RF Exposure Evaluation

Test Mode	Maximum Output Power		Antenna Gain (dBi)	Maximum e.i.r.p		$S_{(W/m^2)} = \frac{PG}{4\pi R^2}$	Limit (W/m ²)
	(dBm)	(mW)		(dBm)	(mW)		
GSM850	-3.31	0.47	0	-3.31	0.47	0.00	>1
PCS1900	25.84	383.71	-0.35	25.49	354.00	0.07	>1
WCDMA Band II	23.84	242.10	1.68	25.52	356.45	0.07	>1
WCDMA Band VI	25.0	316.23	1.61	26.61	458.14	0.09	>1
WCDMA Band V	25.0	316.23	2.51	27.51	563.64	0.11	>1
LTE Band 2	25.0	316.23	-3.47	21.53	142.23	0.03	>1
LTE Band 4	25.0	316.23	1.61	26.61	458.14	0.09	>1
LTE Band 5	25.0	316.23	2.51	27.51	563.64	0.11	>1
LTE Band 7	25.0	316.23	-3.47	21.53	142.23	0.03	>1
LTE Band 12	25.0	316.23	5.14	30.14	1032.76	0.21	>1
LTE Band 13	25.0	316.23	-0.28	24.72	296.48	0.06	>1
LTE Band 17	25.0	316.23	-2.92	22.08	161.44	0.03	>1

b) EUT RF Exposure Evaluation simultaneous transmission operations

FCC/IC RF Exposure Evaluation

Simultaneous transmission mode	MPE ratios	Limit	Result
Bluetooth+GSM/PCS	0.07	≤ 1.0	Pass
Bluetooth+WCDMA	0.11	≤ 1.0	Pass
Bluetooth+LTE	0.21	≤ 1.0	Pass

“RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.”

===== END OF REPORT =====