

TEST REPORT

No. I21N01062-EMC-GSM

for

Rootcloud technology CO.,LTD

T-AMS PRO

Model Name: LI1520-DC-T-GL PRO

FCC ID: 2A07J-LI1520

with

Hardware Version: V1.0

Software Version: V1.0

Issued Date: 2021-07-01

Designation Number: CN1210

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

Test Laboratory:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I21N01062-EMC-GSM	Rev.0	1st edition	2021-07-01

Note: the latest revision of the test report supersedes all previous version



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1. Summary of Test Report

1.1. Test Items

Description	T-AMS PRO
Model Name	LI1520-DC-T-GL PRO
Applicant's name	Rootcloud technology CO.,LTD
Manufacturer's Name	Rootcloud technology CO.,LTD

1.2. Test Standards

10-1-19 Edition
2015
v03r01

1.3. Test Result

Total test 2 items, pass 2 items. Please refer to "6 Summary of Test Results" for detail.

1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China 518000

1.5. Project Data

Testing Start Date: 2020-05-21

Testing End Date: 2021-06-28

1.6. Signature

Liang Yong (Prepared this test report)

Cao Junfei (Approved this test report)

the is the

Zhang Yunzhuan (Reviewed this test report)



2. Client Information

2.1. Applicant Information

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2.2. Manufacturer Information

Company Name:	Rootcloud technology CO.,LTD
Address:	Room 303-309, No. 3, East Road, Pazhou Avenue, Haizhu District,
	Guangzhou 510335
Contact	Joyce Wu
Email	Huiyan.wu@rootcloud.com
Tel.	+86 18306678502



3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	T-AMS PRO
Model Name	LI1520-DC-T-GL PRO
FCC ID	2AO7J-LI1520
Frequency Bands	GSM850; GSM1900
Antenna	External antenna
Power Source	DC12V/DC 24V
Condition of EUT as received	No abnormality in appearance

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Sample Arrival Date
UT03aa	867698042521149	V1.0	V1.0	2021-04-08
*EUT ID: i	s used to identify the t	est sample in the la	ab internally.	

3.3. Internal Identification of AE used during the test

AE ID*	Descripti	on
AE1	GPS/4G Antenna	
AE2	DC power supply	
AE3	USB flash	n disk
AE1		
Model		DAMGA2Y1G1X-SG-J5M
Manufactu	ırer	GLEAD Electronics
AE2		
Model		ZUP60-14
Manufactu	ırer	/
AE3		
Model		CZ73
Manufactu	ırer	SanDisk
*AE ID: is us	sed to iden	tify the test sample in the lab internally.

AE2/AE3:just for testing.



3.4. General Description

The Equipment under Test (EUT) is a model of T-AMS PRO with external antenna.

It consists of normal options: GPS/4G Antenna.

Manual and specifications of the EUT were provided to fulfill the test.

Samples (EUT+AE) undergoing test were selected by the client. Relevant information is provided by the client.

This report is based on LTE Module EG25-G, EG25-G MINIPCIE for for conformance test. According to the declaration by manufacturer, the following tests need to be performed.

······································		
NO.	Test iteam	EUT Operating Mode
1	Out power	GSM
2	Field strength of spurious radiation	GSM

Other results are cited from the report of LTE Module EG25-G, EG25-G.



4. <u>Reference Documents</u>

4.1. <u>Reference Documents for testing</u>

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-19
		Edition
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY	10-1-19
	MATTERS; GENERAL RULES AND REGULATIONS	Edition
ECC Part 24	DEDSONAL COMMUNICATIONS SED//ICES	10-1-19
FCC Fall 24	FERSONAL COMMUNICATIONS SERVICES	Edition
	American National Standard for Compliance Testing of	2015
ANOI 003.20	Transmitters Used in Licensed Radio Services	2015
KDB971168 D01	Power Meas License Digital Systems	v03r01



5. LABORATORY ENVIRONMENT

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	<4 Ω
Voltage Standing Wave Ratio (VSWR)	\leq 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz



6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
- Verdict Column	Р	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured

GSM850

Items	List	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/22.913	A.1	Р
2	Field Strength of Spurious Radiation	2.1053/22.917	A.2	Р

PCS1900

Items	List	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/24.232	A.1	Р
2	Field Strength of Spurious Radiation	2.1053/24.238	A.2	Р



7. Statement

Since the client provides the information of samples in this report, the laboratory is not responsible for the authenticity of sample information.

This report takes measured values as criterion of test conclusion. The test conclusion meets the limit requirements.



8. Test Facilities Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Test Receiver	ESR7	R&S	101676	2021-11-25
2	BiLog Antenna	3142E	ETS-lindgren	0224831	2024-05-24
3	Horn Antenna	3117	ETS-lindgren	00066577	2022-04-02
4	Horn Antenna	QSH-SL-18 -26-S-20	Q-par	17013	2023-01-06
5	Antenna	BBHA 9120D	Schwarzbeck	1593	2022-12-05
6	Antenna	VUBA 9117	Schwarzbeck	207	2023-07-15
7	Antenna	QWH-SL-18 -40-K-SG	Q-par	15979	2023-01-06
8	preamplifier	83017A	Agilent	MY39501110	/
9	Signal Generator	SMB100A	R&S	179725	2021-11-25
10	Fully Anechoic Chamber	FACT3-2.0	ETS-Lindgren	1285	2021-07-19
11	Spectrum Analyzer	FSV40	R&S	101192	2022-01-13
12	Universal Radio Communication Tester	CMU200	R&S	114545	2022-01-13

Note: CAL.: Calibration

Test software

ltem	Name	Vesion
Radiated	EMC32	Version 10.50.40



ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 2.1046, 22.913, 24.232.

A.1.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU-200) to ensure max power transmission and proper modulation.

This result contains max output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

A.1.2 Radiated

A.1.2.1 Description

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage." Rule Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

A.1.2.2 Method of Measurement

 EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



- 2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
- 3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.





In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

 A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}) ,the Substitution Antenna Gain(dBi) (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test. The measurement results are obtained as described below:

Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl} + G_a

- 5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- 6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.



A.1.2.3 Measurement result GSM 850-ERP 22.913(a)

Limits

	Power Step	Burst Peak ERP (dBm)
GPRS	3	≤38.45dBm (7W)
EGPRS	6	≤38.45dBm (7W)

Measurement result GPRS

Frequency(MHz)	P _{Mea} (dBm)	P _{cl} (dB)+ P _{Ag} (dB)	Ga Antenna Correct Gain(dBi) (dB)		ERP(dBm)	Limit(dBm)	Polarization
824.20	-4.25	-33.60	-0.79	2.15	26.41	38.45	Н
836.60	-5.67	-33.50	-0.74	2.15	24.94	38.45	Н
848.80	-7.33	-33.50	-0.73	2.15	23.29	38.45	Н

EGPRS-8PSK

Frequency(MHz)	P _{Mea} (dBm)	P _{cl} (dB)+ P _{Ag} (dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
824.20	-6.83	-33.60	-0.79	2.15	23.83	38.45	Н
836.60	-10.68	-33.50	-0.74	2.15	19.93	38.45	Н
848.80	-9.90	-33.50	-0.73	2.15	20.72	38.45	Н

Frequency: 848.80MHz

Peak ERP(dBm)=PMea(-4.25dBm)-(Pcl+PAg)(-33.60dB)+Ga(-0.79dB)-2.15dB=26.41dBm

ANALYZER SETTINGS: RBW = VBW = 3MHz

Note: The maximum value of expanded measurement uncertainty for this test item is U =

2.72dB(30MHz-3GHz)/3.60dB(3GHz-18GHz)/3.58dB(18GHz-40GHz), k = 2

Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.



PCS1900-EIRP 24.232(c)

Limits

	Power Step	Burst Peak EIRP (dBm)
GPRS	3	≤33dBm (2W)
EGPRS	5	≤33dBm (2W)

Measurement result

GPRS

Frequency(MHz)	P _{Mea} (dBm)	P _{cl} (dB)+ P _{Ag} (dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1850.20	-11.87	-29.40	8.10	25.63	33.00	Н
1880.00	-12.49	-29.30	8.10	24.91	33.00	Н
1909.80	-10.85	-29.30	8.10	26.55	33.00	Н

EGPRS-8PSK

Frequency(MHz)	Pu. (dBm)		Ga Antenna		Limit(dBm)	Polarization
Trequency(MHz)			Gain(dBi)	LIKF (dbill)	Linii(UBIII)	FUIdHZallUH
1850.20	-15.27	-29.40	8.10	22.23	33.00	Н
1880.00	-15.58	-29.30	8.10	21.82	33.00	Н
1909.80	-14.39	-29.30	8.10	23.01	33.00	Н

Frequency: 1880.00MHz

Peak EIRP(dBm)= PMea(-10.85dBm) -(Pcl+PAg)(-29.40dB)+Ga (8.10dB) =26.55dBm

ANALYZER SETTINGS: RBW = VBW = 3MHz

Note: The maximum value of expanded measurement uncertainty for this test item is U =

2.72dB(30MHz-3GHz)/3.60dB(3GHz-18GHz)/3.58dB(18GHz-40GHz), k = 2

Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.





A.2 FIELD STRENGTH OF SPURIOUS RADIATION

Reference

FCC: CFR 2.1053, 22.917, 24.238.

A.2.1 Measurement Method

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set 1MHz as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of GPRS1900 and GPRS850.

The procedure of radiated spurious emissions is as follows:

 EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



- 2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
- 3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere



with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain(dBi) (G_a) should be recorded after test.
A amplifier should be connected in for the test.
The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier.

The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier. The measurement results are obtained as described below:

 $Power(EIRP)=P_{Mea} - P_{pl} + G_a$

- 5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- 6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.



A.2.2 Measurement Limit

Part 24.238 and Part 22.917 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880 MHz and 1909.8 MHz) and GSM850 band (824.2MHz, 836.6MHz, 848.8MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the PCS1900 ,GSM850 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.



A.2.4 Measurement Results Table

Frequency	Channel	Frequency Range	Result
	Low	30MHz-10GHz	Pass
GPRS 850MHz	Middle	30MHz-10GHz	Pass
	High	30MHz-10GHz	Pass
	Low	30MHz-20GHz	Pass
GPRS1900MHz	Middle	30MHz-20GHz	Pass
	High	30MHz-20GHz	Pass

A.2.5 Sweep Table

Working Frequency	Subrange (GHz)	RBW	VBW	Sweep time (s)
	0.03~1	100KHz	300KHz	10
	1-2	1 MHz	3 MHz	2
850MHz	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~10	1 MHz	3 MHz	3
	0.03~1	100KHz	300KHz	10
	1-2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
190010172	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3
	18~20	1 MHz	3 MHz	2



	D (dDma)	Path	Antenna	Peak	Limit	Delerization
	P _{Mea} (ubiii)	loss	Gain(dBi)	ERP(dBm)	(dBm)	Polarization
2939.47	-46.01	1.00	10.70	-38.46	-13.00	Н
5139.00	-64.28	1.30	12.50	-55.23	-13.00	Н
5871.50	-64.45	1.40	13.10	-54.90	-13.00	V
6974.00	-62.67	1.80	12.40	-54.22	-13.00	Н
7970.00	-60.32	1.90	11.30	-53.07	-13.00	V
9862.50	-58.91	2.20	11.20	-52.06	-13.00	Н

GPRS Mode Channel 128/824.2MHz

GPRS Mode Channel 190/836.6MHz

Fraguanov(MHz)	D. (dPm)	Path	Antenna	Peak	Limit	Polorization
Frequency(MHZ)	r _{Mea} (ubiii)	loss	Gain(dBi)	ERP(dBm)	(dBm)	FOIAIIZALIOII
2959.47	-46.23	1.00	10.70	-38.68	-13.00	V
5171.50	-63.20	1.60	12.50	-54.45	-13.00	Н
6239.00	-64.03	1.60	13.10	-54.68	-13.00	V
7284.50	-61.98	1.90	12.00	-54.03	-13.00	Н
8375.00	-60.75	1.80	11.30	-53.40	-13.00	V
9932.00	-57.65	2.20	11.20	-50.80	-13.00	Н

GPRS Mode Channel 251/848.8MHz

Fraguanay/(MHz)	D (dDm)	Path	Antenna	Peak	Limit	Delorization
	P _{Mea} (ubiii)	loss	Gain(dBi)	ERP(dBm)	(dBm)	Polarization
2961.87	-46.71	1.00	10.70	-39.16	-13.00	V
5875.50	-63.93	1.40	13.10	-54.38	-13.00	Н
6551.00	-62.44	1.70	12.40	-53.89	-13.00	V
7515.00	-61.52	1.90	11.30	-54.27	-13.00	V
8475.50	-60.21	1.80	11.30	-52.86	-13.00	Н
9847.00	-59.59	2.30	11.20	-52.84	-13.00	V

Note: The maximum value of expanded measurement uncertainty for this test item is U = 2.72dB(30MHz-3GHz)/3.60dB(3GHz-18GHz)/3.58dB(18GHz-26.5GHz), k = 2



Frequency(MHz)	P _{Mea} (dBm)	Path loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
2935.47	-45.59	1.00	10.70	-35.89	-13.00	V
7400.50	-59.60	1.90	12.00	-49.50	-13.00	V
10344.50	-58.66	2.10	11.30	-49.46	-13.00	Н
12250.00	-57.22	2.60	12.60	-47.22	-13.00	V
15015.50	-56.15	2.40	12.40	-46.15	-13.00	Н
17808.50	-52.55	3.60	12.80	-43.35	-13.00	Н

GPRS Mode Channel 512/1850.2MHz

GPRS Mode Channel 661/1880.0MHz

	D (dDm)	Path	Antenna	Peak	Limit	Delerization
	P _{Mea} (ubiii)	loss	Gain(dBi)	EIRP(dBm)	(dBm)	Polarization
2958.93	-46.43	1.00	10.70	-36.73	-13.00	V
8336.50	-59.98	1.80	11.30	-50.48	-13.00	Н
9970.00	-57.95	2.20	11.20	-48.95	-13.00	Н
12130.50	-57.63	2.70	12.60	-47.73	-13.00	V
14320.50	-55.84	2.60	11.90	-46.54	-13.00	Н
17804.50	-52.98	3.60	12.80	-43.78	-13.00	Н

GPRS Mode Channel 810/1909.8MHz

	D. (dPm)	Path	Antenna	Peak	Limit	Delorization
	P _{Mea} (ubm)	loss	Gain(dBi)	EIRP(dBm)	(dBm)	Polarization
2841.60	-45.75	1.00	10.70	-36.05	-13.00	V
8023.50	-60.07	2.00	11.30	-50.77	-13.00	Н
9486.00	-58.51	2.10	11.60	-49.01	-13.00	Н
11999.50	-56.79	2.60	11.00	-48.39	-13.00	V
14840.50	-54.96	2.70	11.20	-46.46	-13.00	V
17814.50	-52.05	3.60	12.80	-42.85	-13.00	Н

Note: The maximum value of expanded measurement uncertainty for this test item is U = 2.72dB(30MHz-3GHz)/3.60dB(3GHz-18GHz)/3.58dB(18GHz-40GHz), k = 2

END OF REPORT