1 Cover Page

RF Exposure Evaluation Report

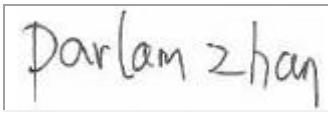
Application No.:	SHCR2108000032AT
FCC ID:	2A5PE-YUSHU001
Applicant:	Unitree
Address of Applicant:	3rd Floor, Building 1, Fengda Creative Park, No. 88 Dongliu Road, Binjiang District, Hangzhou, Zhejiang,China
Manufacturer:	Unitree
Address of Manufacturer:	3rd Floor, Building 1, Fengda Creative Park, No. 88 Dongliu Road, Binjiang District, Hangzhou, Zhejiang,China
Factory:	Unitree
Address of Factory:	3rd Floor, Building 1, Fengda Creative Park, No. 88 Dongliu Road, Binjiang District, Hangzhou, Zhejiang,China
Equipment Under Test (EUT):	
EUT Name:	Quadruped Robot
Model No.:	Go1,Go1 Air,Go1 Edu,Go1 Pro,Go1 Max,Go1 Nx,Go1 Pro Max¤
¤	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) :	FCC Rules 47 CFR §2.1091 KDB447498 D01 General RF Exposure Guidance v06
Date of Receipt:	2021-09-02
Date of Test:	2021-11-05 to 2022-01-07 and 2022-05-05
Date of Issue:	2022-05-05
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan
Laboratory Manager

NO.588 West Jindu Road,Songjiang District,Shanghai,China 201612 t(86-21)61915666 f(86-21)61915678 www.sgsgroup.com.cn
中国·上海·松江区金都西路588号 邮编: 201612 t(86-21)61915666 f(86-21)61915678 e sgs.china@sgs.com

Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2022-03-07	/
01	Added UWB assessment	2022-05-05	/

Authorized for issue by:				
				
		Wade Zhang / Project Engineer		
				
		Parlam Zhan /Reviewer		

2 Contents

Page

1 COVER PAGE 1
2 CONTENTS 3
3 GENERAL INFORMATION 4
3.1 GENERAL DESCRIPTION OF E.U.T. 4
3.2 TECHNICAL SPECIFICATIONS 4
3.3 TEST LOCATION 8
3.4 TEST FACILITY 8
4 TEST STANDARDS AND LIMITS 9
4.1 FCC RADIOFREQUENCY RADIATION EXPOSURE LIMITS: 9
5 MEASUREMENT AND CALCULATION 10
5.1 MAXIMUM TRANSMIT POWER 10
5.2 MPE CALCULATION 12

3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 22.2V 6Ah Battery Charger: Model: KS150DU-2520600 Input: AC 100-240V, 50/60Hz, 2.5A Output: DC 25.2V 6.0A

3.2 Technical Specifications

5G WiFi:

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band III	802.11a/n(HT20)/ac(HT20)	5745-5825	5
		802.11n(HT40)/ac(HT40)	5755-5795	2
		802.11ac(HT80)	5775	1
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			
Date Rate:	802.11a:6/9/12/18/24/36/48/54Mbps 802.11n: MCS0-MCS7 802.11ac: VHT MCS0-MCS7			
Channel Spacing:	802.11a/n(HT20)/ac(HT20): 20MHz 802.11n(HT40)/ac(HT40): 40MHz 802.11ac(HT80): 80MHz			
TPC Function:	Not support			
DFS Function:	Slaver without radar detection			
Antenna Gain:	Antenna 1: 4dBi Antenna 2: 4dBi (Provided by manufacturer) Directional gain: 7.01dBi			
Antenna Type:	Antenna 1: Dipole antenna Antenna 2: Dipole antenna			

UWB:

Location for use:	Indoors and Outdoors
Antenna Gain:	0dBi (Provided by manufacturer)
Antenna Type:	Dipole Antenna
Modulation Type:	BPM-BPSK
Number of Channels:	1
Frequency range:	4492.8MHz (3100MHz-10600MHz)

LTE:

Hardware Version:	R1.0
Software Version:	EG25GGBR07A06M4G
Sample Type:	☐ Portable Device, ☒Module
Antenna Type:	☒ External, ☐ Integrated
Antenna Gain:	GSM850: 2.29dBi; GSM1900:1.59dBi WCDMA BAND II:1.59dBi WCDMA BAND VI:2dBi WCDMA BAND V:2.29dBi LTE BAND 2:1.59dBi; LTE BAND 4:2dBi; LTE BAND 5:2.29dBi; LTE BAND 7: 3dBi; LTE BAND 12: 3.26dBi; LTE BAND 13: 4.45dBi; LTE BAND 25: 1.59dBi; LTE BAND 26: 2.53dBi; LTE BAND 38: 2.06dBi; LTE BAND 41: 3dBi;

Characteristics	Description		
Radio System Type	☒ GSM		
	☒ UMTS		
	☒ LTE		
Supported Frequency Range	BAND	TX	RX
	GSM850	824 to 849 MHz	869 to 894 MHz
	GSM1900	1850 to 1910 MHz	1930 to 1990 MHz
	UMTS BAND II	1850 to 1910 MHz	1930 to 1990 MHz
	UMTS BAND IV	1710 to 1755 MHz	2110 to 2155 MHz
	UMTS BAND V	824 to 849 MHz	869 to 894 MHz
	LTE BAND 2	1850 to 1910 MHz	1930 to 1990 MHz
	LTE BAND 4	1710 to 1755 MHz	2110 to 2155 MHz
	LTE BAND 5	824 to 849 MHz	869 to 894 MHz
	LTE BAND 7	2500 to 2570 MHz	2620 to 2690 MHz
	LTE BAND 12	699 to 716 MHz	729 to 746 MHz

	LTE BAND 13	777 to 787 MHz	746 to 756 MHz
	LTE BAND 25	1850 to 1915MHz	1930 to 1995 MHz
	LTE BAND 26 (814 to 824 MHz)	814 to 824MHz	859 to 869 MHz
	LTE BAND 26 (824 to 849 MHz)	824 to 849 MHz	869 to 894 MHz
	LTE BAND 38	2570 to 2620MHz	2570 to 2620MHz
	LTE BAND 41	2496 to 2690MHz	2496 to 2690MHz
Target TX Output Power	GSM850:35 dBm GSM1900: 32dBm UMTS BAND II: 25dBm UMTS BAND IV: 25dBm UMTS BAND V: 25dBm LTE BAND 2: 25dBm LTE BAND 4: 25dBm LTE BAND 5: 25dBm LTE BAND 7: 25dBm LTE BAND 12: 25dBm LTE BAND 13: 25dBm LTE BAND 25: 25dBm LTE BAND 26: 25dBm LTE BAND 38: 25dBm LTE BAND 41: 25dBm		

Supported Channel Bandwidth	GSM system:	☒0.2 MHz
	UMTS system:	☒5 MHz
	LTE BAND 2	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
	LTE BAND 4	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
	LTE BAND 5	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz
	LTE BAND 7	☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
	LTE BAND 12	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz
	LTE BAND 13	☒5 MHz; ☒10 MHz
	LTE BAND 25	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
	LTE BAND 26(814-824)	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz;
	LTE BAND 26(824-849)	☒1.4 MHz;☒3 MHz; ☒5 MHz; ☒10 MHz; ☒15 MHz
	LTE BAND38	☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
	LTE BAND41	☒5 MHz; ☒10 MHz; ☒15 MHz, ☒20 MHz
Characteristics	Description	
Designation of Emissions (Remark: the necessary bandwidth of which is the worst value from	GSM850	247KGXW; 245KG7W
	GSM1900	249KGXW; 249KG7W
	UMTS BAND II	4M15F9W;
	UMTS BAND IV	4M14F9W;
	UMTS BAND V	4M13F9W;
	LTE BAND 2	1M09G7D;1M09W7D 2M70G7D;2M69W7D

NO.588 West Jindu Road,Songjiang District,Shanghai,China 201612 t(86-21)61915666 f(86-21)61915678 www.sgsgroup.com.cn
中国·上海·松江区金都西路588号 邮编: 201612 t(86-21)61915666 f(86-21)61915678 e sgs.china@sgs.com

the measured occupied bandwidths for each type of channel bandwidth configuration.)		4M48G7D;4M49W7D 8M93G7D;8M93W7D 13M5G7D;13M5W7D 17M9G7D;17M9W7D
	LTE BAND 4	1M10G7D;1M09W7D 2M70G7D;2M69W7D 4M48G7D;4M49W7D 8M93G7D;8M91W7D 13M4G7D;13M4W7D 17M9G7D;17M9W7D
	LTE BAND 5	1M09G7D;1M09W7D 2M70G7D;2M69W7D; 4M48G7D;4M49W7D 8M93G7D;8M93W7D
	LTE BAND 7	4M48G7D;4M49W7D 8M93G7D;8M91W7D 13M5G7D;13M4W7D 17M9G7D;17M9W7D
	LTE BAND 12	1M09G7D;1M09W7D 2M70G7D;2M69W7D 4M48G7D;4M50W7D 8M93G7D;8M93W7D
	LTE BAND13	4M48G7D;4M49W7D 8M91G7D;8M91W7D
	LTE BAND 25	1M09G7D;1M09W7D 2M70G7D;2M69W7D 4M47G7D;4M49W7D 8M91G7D;8M95W7D 13M5G7D;13M4W7D 17M9G7D;17M9W7D
	LTE BAND 26 (814-824)	1M09G7D;1M09W7D 2M70G7D;2M69W7D 4M48G7D;4M50W7D 8M91G7D;8M91W7D
	LTE BAND 26 (824-849)	1M09G7D;1M09W7D 2M70G7D;2M69W7D 4M48G7D;4M49W7D 8M95G7D;8M93W7D 13M5G7D;13M4W7D
	LTE BAND 38	4M48G7D;4M49W7D 8M91G7D;8M91W7D 13M5G7D;13M5W7D 17M8G7D;17M8W7D
	LTE BAND 41	4M48G7D;4M50W7D 8M91G7D;8M91W7D 13M5G7D;13M5W7D 17M9G7D;17M9W7D

3.3 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab
588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China
Tel: +86 21 6191 5666 Fax: +86 21 6191 5678

No tests were sub-contracted.

3.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA).

- **FCC (Designation Number: CN1301)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

- **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory Company Number: 8617A

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 respectively.

4 Test Standards and Limits

4.1 FCC Radiofrequency radiation exposure limits:

According to§1.1310, the limit for general population/uncontrolled exposures

Frequency	Power density(mW/cm^2)	Averaging time(minutes)
300MHz~1.5GHz	f/1500	30
1.5GHz~100GHz	1.0	30

5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report SHCR210800003202-5G WiFi.

Test Mode	Test Channel	Power [dBm]			Power [mW]		
		ANT1	ANT2	MIMO	ANT1	ANT2	MIMO
11A	5745	13.65	14.31	N/A	23.17	26.98	N/A
11A	5785	13.58	13.84	N/A	22.80	24.21	N/A
11A	5825	13.58	14.1	N/A	22.80	25.70	N/A
11N20	5745	12.92	14.09	16.55	19.59	25.64	45.19
11N20	5785	13.44	13.98	16.73	22.08	25.00	47.10
11N20	5825	13.55	13.84	16.71	22.65	24.21	46.88
11N40	5755	14.17	15	17.62	26.12	31.62	57.81
11N40	5795	14.4	14.86	17.65	27.54	30.62	58.21
11AC20	5745	12.95	13.92	16.47	19.72	24.66	44.36
11AC20	5785	13.41	14.2	16.83	21.93	26.30	48.19
11AC20	5825	13.51	14	16.77	22.44	25.12	47.53
11AC40	5755	14.09	15.12	17.65	25.64	32.51	58.21
11AC40	5795	14.41	14.93	17.69	27.61	31.12	58.75
11AC80	5775	14.55	15.2	17.90	28.51	**33.11**	**61.66**

The Power Data is based on the RF Test Report SHCR210800003203-UWB.

Frequency (MHz)	Measured Radiated Output Power (dBm)
4492.8	-53.61

The Power Data is based on the RF Test Report HR/2019/1001601-LTE.

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Max Conducted Average Output Power (dBm)	Output Power to Antenna (dBm)	EIRP(ERP) Limit (dBm)	Output Power to Antenna (mw)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	Gain according to EIRP (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
GSM850	824.2	2.29	25.81	25.95	38.45	381.0658	0.1284	0.5495	14.79	8.60	8.60	Pass
GSM1900	1850.2	1.59	22.81	24.40	33.00	190.9853	0.0548	1.0000	10.19	14.20	10.19	Pass
WCDMA B2	1852.4	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
WCDMA B4	1712.4	2.00	25.00	27.00	30.00	316.2278	0.0997	1.0000	5.00	12.01	5.00	Pass
WCDMA B5	826.4	2.29	25.00	25.14	38.45	316.2278	0.1066	0.5509	15.60	9.42	9.42	Pass
LTE B2	1850.7	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
LTE B4	1710.7	2.00	25.00	27.00	30.00	316.2278	0.0997	1.0000	5.00	12.01	5.00	Pass
LTE B5	824.70	2.29	25.00	25.14	38.45	316.2278	0.1066	0.5498	15.60	9.41	9.41	Pass
LTE B7	2502.50	3.00	25.00	28.00	33.00	316.2278	0.1255	1.0000	8.00	12.01	8.00	Pass
LTE B12	699.70	3.26	25.00	26.11	34.77	316.2278	0.1333	0.4665	11.92	8.70	8.70	Pass
LTE B13	779.50	4.45	25.00	27.30	34.77	316.2278	0.1753	0.5197	11.92	9.16	9.16	Pass
LTE B25	1850.7	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
LTE B26(814-824)	814.7	2.53	25.00	25.38	50.00	316.2278	0.1126	0.5431	27.15	9.36	9.36	Pass
LTE B26(824-849)	824.7	2.53	25.00	25.38	38.45	316.2278	0.1126	0.5498	15.60	9.41	9.41	Pass
LTE B38	2572.5	2.06	25.00	27.06	33.00	316.2278	0.1011	1.0000	8.00	12.01	8.00	Pass
LTE B41	2498.5	3.00	25.00	28.00	33.00	316.2278	0.1255	1.0000	8.00	12.01	8.00	Pass

5.2 MPE Calculation

According to the formula $S=P/4\pi R^2$, we can calculate S which is MPE.

Note:

1) P (mW)

2) R = distance to the center of radiation of antenna (in meter) = 20cm

3) MPE limit = 1mW/cm²

For 5GHz WiFi:

The max. antenna gain is 4 dBi

Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
33.11	2.512	20	0.01655	1	Pass

In MIMO mode:

The max. antenna gain is 7.01 dBi

Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
61.66	5.023	20	0.06162	1	Pass

For GSM/LTE:

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Max Conducted Average Output Power (dBm)	Output Power to Antenna (dBm)	EIRP(ERP) Limit (dBm)	Output Power to Antenna (mw)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	Gain according to EIRP (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
GSM850	824.2	2.29	25.81	25.95	38.45	381.0658	0.1284	0.5495	14.79	8.60	8.60	Pass
GSM1900	1850.2	1.59	22.81	24.40	33.00	190.9853	0.0548	1.0000	10.19	14.20	10.19	Pass
WCDMA B2	1852.4	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
WCDMA B4	1712.4	2.00	25.00	27.00	30.00	316.2278	0.0997	1.0000	5.00	12.01	5.00	Pass
WCDMA B5	826.4	2.29	25.00	25.14	38.45	316.2278	0.1066	0.5509	15.60	9.42	9.42	Pass
LTE B2	1850.7	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
LTE B4	1710.7	2.00	25.00	27.00	30.00	316.2278	0.0997	1.0000	5.00	12.01	5.00	Pass
LTE B5	824.70	2.29	25.00	25.14	38.45	316.2278	0.1066	0.5498	15.60	9.41	9.41	Pass
LTE B7	2502.50	3.00	25.00	28.00	33.00	316.2278	0.1255	1.0000	8.00	12.01	8.00	Pass
LTE B12	699.70	3.26	25.00	26.11	34.77	316.2278	0.1333	0.4665	11.92	8.70	8.70	Pass
LTE B13	779.50	4.45	25.00	27.30	34.77	316.2278	0.1753	0.5197	11.92	9.16	9.16	Pass
LTE B25	1850.7	1.59	25.00	26.59	33.00	316.2278	0.0907	1.0000	8.00	12.01	8.00	Pass
LTE B26(814-824)	814.7	2.53	25.00	25.38	50.00	316.2278	0.1126	0.5431	27.15	9.36	9.36	Pass
LTE B26(824-849)	824.7	2.53	25.00	25.38	38.45	316.2278	0.1126	0.5498	15.60	9.41	9.41	Pass
LTE B38	2572.5	2.06	25.00	27.06	33.00	316.2278	0.1011	1.0000	8.00	12.01	8.00	Pass
LTE B41	2498.5	3.00	25.00	28.00	33.00	316.2278	0.1255	1.0000	8.00	12.01	8.00	Pass

For UWB:

The max. antenna gain is 0 dBi

Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
0.000004355	1.000	20	0.000000001	1	Pass

Consider the GSM/LTE Module, UWB and 5G WIFI module can simultaneous transmitting, so the maximum rate of MPE is 0.06162/1+0.1284/0.5495+0.000000001/1=0.295 mW/cm²<1 mW/cm².

So according to the KDB447498 section 7.2 determine the device is exclusion from SAR test..

--End of the Report--