RF Exposure evaluation

Report Reference No.......................:	GTS20220215005-1-5
FCC ID. ....:	2AVE7-D042A
Compiled by (position+printed name+signature) .:	File administrators Peter Xiao
Supervised by (position+printed name+signature) .:	Test Engineer Oliver Ou
Approved by (position+printed name+signature) .:	Manager Simon Hu
Date of issue ....:	Feb. 22, 2022
Representative Laboratory Name.:	**Shenzhen Global Test Service Co.,Ltd.**
Address ....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong
Applicant's name............................:	**Shenzhen Hotack Technology Co.,Ltd**
Address ....:	Floor 4,Building A1,130 Silicon Valley Power Third Park, Si Li Road,guanlan street,Longhua District, Shenzhen China 518000
Test specification ....:	
Standard..:	**47CFR §1.1310 Basis and purpose** **47CFR §2.1091 Radiofrequency radiation exposure evaluation: mobile devices** **KDB447498 D01 General RF Exposure Guidance v06**
TRF Originator...................................:	Shenzhen Global Test Service Co.,Ltd.
Master TRF ....:	Dated 2014-12

Test item description ....:	**Smart Projector**
Trade Mark ....:	N/A
Manufacturer ....:	Shenzhen Hotack Technology Co.,Ltd
Model/Type reference ....:	D042
Listed Models ....:	D042A, D042S, D042H, D042T, BW-VT2
Hardware Version ....:	N/A
Software Version ....:	N/A
Rating ....:	DC 12.0V/2.0A by Adapter
Result ....:	**PASS**

T E S T   R E P O R T

Test Report No. :	GTS20220215005-1-5	Feb. 22, 2022
		Date of issue

Equipment under Test	:	Smart Projector
Model /Type	:	D042
Listed model	:	D042A, D042S, D042H, D042T, BW-VT2
Applicant	:	**Shenzhen Hotack Technology Co.,Ltd**
Address	:	Floor 4,Building A1,130 Silicon Valley Power Third Park, Si Li Road,guanlan street,Longhua District, Shenzhen China 518000
Manufacturer	:	**Shenzhen Hotack Technology Co.,Ltd**
Address	:	Floor 4,Building A1,130 Silicon Valley Power Third Park, Si Li Road,guanlan street,Longhua District, Shenzhen China 518000

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. **S U M M A R Y**

1.1 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:
● - supplied by the manufacturer

○ - supplied by the lab

● /	Length (m) :	/
	Shield :	/
	Detachable :	/

1.2 Product Description

Product Name	Smart Projector
Trade Mark	N/A
Model/Type reference	D042
List Models	D042A, D042S, D042H, D042T, BW-VT2
Model Declaration	PCB board, structure and internal of these model(s) are the same, Only the model name different , So no additional models were tested.
Power supply:	DC 12.0V/2.0A by Adapter
Sample ID	GTS20220215005-1-1# & GTS20220215005-1-2#
Bluetooth	
Operation frequency	2402-2480MHz
Channel Number	79 channels for Bluetooth (DSS) 40 channels for Bluetooth (DTS)
Channel Spacing	1MHz for Bluetooth (DSS) 2MHz for Bluetooth (DTS)
Modulation Type	GFSK, π/4-DQPSK, 8DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
WIFI(2.4G Band)	
Frequency Range	2412MHz ~ 2462MHz
Channel Spacing	5MHz
Channel Number	11 Channel for 20MHz bandwidth(2412~2462MHz) 7 Channel for 40MHz bandwidth(2422~2452MHz)
Modulation Type	802.11b: DSSS; 802.11g/n: OFDM
WIFI(5.2G Band)	
Frequency Range	5180MHz ~ 5240MHz
Channel Number	4 channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Modulation Type	802.11a/n/ac: OFDM
WIFI (5.8G Band)	
Frequency Range	5745MHz ~ 5825MHz
Channel Number	5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	802.11a/n/ac: OFDM
Antenna Description	Internal Antenna, 4.62dBi(Max.) for 2.4G Band and 3.33dBi(Max.) for 5G Band

1.3 Product Difference Description

The difference between D042 is show in the below table:

main information	D042 (with Type-c port)	D042 (without Type-c port)
Main board	with Type-c port	without Type-c port
Frequency bands	support Wi-Fi2.4G&5G support BT;	The same
BT/ Wi-Fi module	EWN-UWE56221AA	The same
BT/ Wi-Fi antenna	2.4G+5G built-in FPC antenna	The same
Appearance	The same	The same
Dimension	72X72X106mm	The same
CPU	RK3228A 4 cores, A7 core, 1.2G	The same
GPU	support	The same
Memory	2GB DDR3	The same
SSD/EMMC	16GB	The same
Adapter	CW1202000US	The same

2 . T E S T E N V I R O N M E N T

2.1 Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

2.2 Test Facility

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

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.
A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.
Industry Canada Registration Number. is 24189.
FCC Designation Number is CN1234.
FCC Registered Test Site Number is165725.

2.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

2.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. METHOD OF MEASUREMENT

3.1 Applicable Standard

According to §1.1307(b)(1), 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 of the Commission's guidelines.
According to §1.1310 and §2.1091 RF exposure is calculated.
KDB447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

3.2 Requirement

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.
 In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.
In accordance with KDB447498 D01 General RF Exposure Guidance v06 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0. 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 MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3.3 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
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 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	$(180/f^2)$*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz
*=Plane-wave equivalent power density

3.4 MPE Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$
Where: S=power density
    P=power input to antenna
    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

As declared by the Applicant, the EUT transmits with the maximum soure-baed Duty Cycle of 100%-see the User manual, and the EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum mobile separation distance, r =20cm, as well as the gain of the used antenna is 4.62dBi for BT&WLAN, and the power drift from Turn-up Procedure provide by manufacturer as following states, the RF power density can be obtained.

3.5 Antenna Information

D042 can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 0	BT&WLANANT 0	Internal antenna	2.4 – 2.5 GHz 5.0 – 6.0 GHz	4.62dBi(Max.) for 2.4G band 3.33dBi(Max.) for 5G band

4. Conducted Power Results

Bluetooth

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	9.21
	39	2441	10.43
	78	2480	10.14
π/4DQPSK	0	2402	10.55
	39	2441	11.95
	78	2480	11.53
8DPSK	0	2402	10.80
	39	2441	12.25
	78	2480	11.83
GFSK(BT LE)	0	2402	-3.84
	19	2440	-1.88
	39	2480	-2.41

2.4GWLAN

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11b	01	2412	20.18
	06	2437	21.74
	11	2462	22.60
802.11g	01	2412	22.78
	06	2437	24.19
	11	2462	25.27
802.11n(HT20)	01	2412	22.41
	06	2437	23.77
	11	2462	24.55
802.11n(HT40)	03	2422	23.51
	06	2437	24.06
	09	2452	25.09

5.2GWLAN

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	36	5180	16.11
	40	5200	16.51
	48	5240	16.47
802.11n20	36	5180	16.60
	40	5200	16.39
	48	5240	16.09
802.11ac20	36	5180	19.23
	40	5200	19.10
	48	5240	19.51
802.11n40	38	5190	16.58
	46	5230	17.47
802.11ac40	38	5190	20.48
	46	5230	20.56
802.11ac80	42	5210	19.76

5.8GWLAN

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	149	5745	16.67
	157	5785	16.07
	165	5825	16.07
802.11n20	149	5745	16.53
	157	5785	16.55
	165	5825	16.61
802.11ac20	149	5745	19.25
	157	5785	18.81
	165	5825	19.02
802.11n40	151	5755	16.64
	159	5795	17.20
802.11ac40	151	5755	20.15
	159	5795	20.28
802.11ac80	155	5775	19.05

5. Manufacturing Tolerance

Bluetooth

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	9.0	10.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	10.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	10.0	12.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
GFSK BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-4.0	-2.0	-3.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWLAN

IEEE 802.11b (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	18.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	19.0	20.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	19.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	18.0	18.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0

5.2GWLAN

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	16.0	17.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	20.0	20.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	19.0	/	/
Tolerance ±(dB)	1.0	/	/

5.8GWLAN

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm9	19.0	18.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target 6dBm)710.0	16.0	17.0	
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target20dBm2010.0	20.0	20.0	
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155	/	/
Target 9dBm)	19.0	/	/
Tolerance ±(dB)	1.0	/	/

6 . Measurement Results

6.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the mi11imum separation distance, r =20cm, as well a12 the gain of the used antenna refer to an13enna information, the RF power density can be o-1tained.

BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
GFSK	11.00	12.5893	4.62	2.8973	0.0073	1.0000
π/4DQPSK	12.00	15.8489	4.62	2.8973	0.0091	1.0000
8DPSK	13.00	19.9526	4.62	2.8973	0.0115	1.0000
GFS1(BT LE)	-1.00	0.7943	4.62	2.8973	0.0005	1.0000

2.4GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
802.11b	20.00	50.1187	4.62	2.8973	0.0576	1.0000
802.11g	22.00	100.0000	4.62	2.8973	0.0914	1.0000
802.11n(HT20)	21.00	100.0000	4.62	2.8973	0.0726	1.0000
802.11n(HT40)	20.00	79.4328	4.62	2.8973	0.0576	1.0000

5.2GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MP20 Limits (mW/cm^2)
	dBm	mW				
802.11a	17.00	50.1187	3.33	2.1528	0.0215	1.0000
802.11n20	17.00	50.1187	3.33	2.1528	0.0215	1.0000
802.11ac20	20.00	100.0000	3.33	2.1528	0.0428	1.0000
802.11n40	18.00	63.0957	3.33	2.1528	0.0270	1.0000
802.11ac40	21.00	125.8925	3.33	2.1528	0.0539	1.0000
802.11ac80	20.00	100.0000	3.33	2.1528	0.0428	1.0000

5.8GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MP17.00
	dBm	20.00				
802.11a	17.00	50.1187	3.33	2.1528	0.0215	1.0000
802.11n20	17.00	50.1187	3.33	2.1528	0.0215	1.0000
802.11ac20	20.00	100.0000	3.33	2.1528	0.0428	1.0000
802.11n40	18.00	63.0957	3.33	2.1528	0.0270	1.0000
802.11ac40	21.00	125.8925	3.33	2.1528	0.0539	1.0000
802.11ac80	20.00	100.0000	3.33	2.1528	0.0428	1.0000

Remark:
1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;
3.The sample support one Bluetooth & WLAN modular, and one Bluetooth &WLAN antenna, No Need consider simultaneous transmission ;

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB447498 D01 General RF Exposure Guidance v06, No SAR is required.

....................End of Report.........................