

RF Exposure

Applicant: Zhejiang Hanshow Technology Co., Ltd.
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Manufacturer: Zhejiang Hanshow Technology Co., Ltd.
Address of Manufacturer: Bld. 33, No. 966 xiuyuan Rd., BeiKeJian Innovation Park, XiuZhou District, Jiaxing, Zhejiang, China
Factory: Dongguan AoJinKe Electronic Technology Co.,Ltd
Address of Factory: 2nd Floor,Building A,No.8,Juxiang 1 Road,Qiufu Road Community,Dalang Town,Dongguan, China
Equipment Under Test (EUT):
Product: Digital signage
Model No.: HS-AT2301, HS-AT2303, HS-AT2311, HS-AT2313, HSAT2321, HS-AT2323, HS-AT2331, HS-AT2333, HS-AT2351, HSAT2353, HS-AT2391, HS-AT2393
FCC ID: 2AHB5-AT2301
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2020-02-24
Date of Test: 2020-02-24 to 2020-03-03
Date of Issue: 2020-03-03
Test Result : **PASS***

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

Authorized Signature:

A circular logo for GTS Global United Technology Services Co., Ltd. is visible. The logo contains the text "GTS", "GLOBAL TESTING", and "GLOBAL UNITED TECHNOLOGY SERVICES CO., LTD.". Overlaid on the logo is a handwritten signature in black ink, which appears to read "Robinson Lo".

Robinson Lo

Laboratory Manager

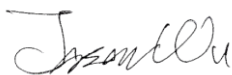
This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
GTS202002000019	Rev.01	Initial report	2020-03-03

Prepared By:



Date:

2020-03-03

Project Engineer

Check By:



Date:

2020-03-03

Reviewer

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3 General Information

3.1 General Description of EUT

Product Name:	Digital signage
Model No.:	HS-AT2301, HS-AT2303, HS-AT2311, HS-AT2313, HSAT2321, HS-AT2323, HS-AT2331, HS-AT2333, HS-AT2351, HSAT2353, HS-AT2391, HS-AT2393
Test Model No.:	HS-AT2311
Remark:	All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are colour and model name for commercial purpose.
Serial No.:	200700005195000155
Hardware version:	V04
Software version:	8171090000241
Sample Type:	☒ Mobile ☐ Portable ☐ Fix Location
Power Supply:	INPUT: 100-240V~50/60Hz 1.0A Max OUTPUT: 12V---2.0A

3.2 General Description of 2.4G WIFI

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g : OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20/40): OFDM (64QAM, 16QAM,QPSK,BPSK)
Test Software of EUT:	RF test (manufacturer declare)
Antenna Type:	FPC antenna
Antenna Gain:	5.0dBi

3.3 General Description of 5G WIFI

Operation Frequency:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250 MHz IEEE802.11n/ac(40M): 5150MHz ~5250 MHz IEEE802.11ac(80M): 5150MHz ~5250 MHz IEEE 802.11a/n/ac(20M): 5725MHz ~5850 MHz IEEE802.11n/ac(40M): 5725MHz ~5850 MHz IEEE802.11ac(80M): 5725MHz ~5850 MHz
Channel Numbers:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n/ac(40M): 5725MHz ~5850MHz/ 2 channel IEEE 802.11ac(80M): 5725MHz ~5850MHz/ 1 channel
Channel Separation:	IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz IEEE 802.11n-HT40/ac-VHT40: 40 MHz

	IEEE 802.11ac-VHT80/: 80 MHz
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)
Test Software of EUT:	RF test (manufacturer declare)
Antenna Type:	FPC antenna
Antenna Gain:	3.23dBi

4 RF Exposure Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
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
(B) 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
300–1500			f/1500	30
1500–100,000			1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.2 1.1.3 EUT RF Exposure Evaluation

1) For 2.4G WIFI

Measurement Data

IEEE for 802.11b mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	12.45	12.5±1	13.5	22.387
Middle(2437MHz)	12.82	12.5±1	13.5	22.387
Highest(2462MHz)	12.98	12.5±1	13.5	22.387
IEEE for 802.11g mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	10.43	10±1	11	12.589
Middle(2437MHz)	10.3	10±1	11	12.589
Highest(2462MHz)	10.5	10±1	11	12.589
IEEE for 802.11n(HT20) mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	9.1	9±1	10	10.000
Middle(2437MHz)	9.75	9±1	10	10.000
Highest(2462MHz)	9.67	9±1	10	10.000
IEEE for 802.11n(HT40) mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2422MHz)	8.76	8.5±1	9.5	8.913
Middle(2437MHz)	9.29	8.5±1	9.5	8.913
Highest(2452MHz)	9.01	8.5±1	9.5	8.913

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
22.387	5.0	0.014	1.0	PASS

Note: 1) Refer to report No. GTS202002000019F01 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (22.387 * 3.16) / (4 * 3.1416 * 20^2) = 0.014$$

2) For 5G WIFI

Measurement Data

802.11a mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	14.12	13.0±1.5	14.5	28.184
5200	Ant1	12.39	13.0±1.5	14.5	28.184
5240	Ant1	12.56	13.0±1.5	14.5	28.184
5260	Ant1	12.53	13.0±1.5	14.5	28.184
5280	Ant1	12.44	13.0±1.5	14.5	28.184
5320	Ant1	12.41	13.0±1.5	14.5	28.184
5500	Ant1	12.47	13.0±1.5	14.5	28.184
5580	Ant1	12.60	13.0±1.5	14.5	28.184
5700	Ant1	12.65	13.0±1.5	14.5	28.184
5745	Ant1	12.40	13.0±1.5	14.5	28.184
5785	Ant1	13.02	13.0±1.5	14.5	28.184
5825	Ant1	12.70	13.0±1.5	14.5	28.184
802.11n(HT20) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	12.74	12.5±1.5	14.0	25.119
5200	Ant1	12.54	12.5±1.5	14.0	25.119
5240	Ant1	12.56	12.5±1.5	14.0	25.119
5260	Ant1	12.77	12.5±1.5	14.0	25.119
5280	Ant1	12.39	12.5±1.5	14.0	25.119
5320	Ant1	13.12	12.5±1.5	14.0	25.119
5500	Ant1	12.96	12.5±1.5	14.0	25.119
5580	Ant1	11.93	12.5±1.5	14.0	25.119
5700	Ant1	13.51	12.5±1.5	14.0	25.119
5745	Ant1	13.62	12.5±1.5	14.0	25.119
5785	Ant1	12.78	12.5±1.5	14.0	25.119
5825	Ant1	12.96	12.5±1.5	14.0	25.119

802.11n(HT40) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1	12.57	13.0±1.5	14.5	28.184
5230	Ant1	12.76	13.0±1.5	14.5	28.184
5270	Ant1	12.06	13.0±1.5	14.5	28.184
5310	Ant1	13.13	13.0±1.5	14.5	28.184
5510	Ant1	12.55	13.0±1.5	14.5	28.184
5550	Ant1	12.97	13.0±1.5	14.5	28.184
5670	Ant1	14.03	13.0±1.5	14.5	28.184
5755	Ant1	13.02	13.0±1.5	14.5	28.184
5795	Ant1	12.80	13.0±1.5	14.5	28.184
802.11ac(VHT20) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	12.90	12.0±1.5	13.5	22.387
5200	Ant1	12.68	12.0±1.5	13.5	22.387
5240	Ant1	11.69	12.0±1.5	13.5	22.387
5260	Ant1	12.67	12.0±1.5	13.5	22.387
5280	Ant1	12.58	12.0±1.5	13.5	22.387
5320	Ant1	11.61	12.0±1.5	13.5	22.387
5500	Ant1	12.13	12.0±1.5	13.5	22.387
5580	Ant1	11.80	12.0±1.5	13.5	22.387
5700	Ant1	12.70	12.0±1.5	13.5	22.387
5745	Ant1	13.38	12.0±1.5	13.5	22.387
5785	Ant1	12.64	12.0±1.5	13.5	22.387
5825	Ant1	11.28	12.0±1.5	13.5	22.387

802.11ac(VHT40) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1	13.76	13.0±1.5	14.5	28.184
5230	Ant1	12.14	13.0±1.5	14.5	28.184
5270	Ant1	12.62	13.0±1.5	14.5	28.184
5310	Ant1	13.18	13.0±1.5	14.5	28.184
5510	Ant1	12.47	13.0±1.5	14.5	28.184
5550	Ant1	13.33	13.0±1.5	14.5	28.184
5670	Ant1	13.74	13.0±1.5	14.5	28.184
5755	Ant1	14.14	13.0±1.5	14.5	28.184
5795	Ant1	14.17	13.0±1.5	14.5	28.184
802.11acV(HT80) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5210	Ant1	13.91	13.0±1.0	14.0	25.119
5290	Ant1	13.39	13.0±1.0	14.0	25.119
5530	Ant1	12.54	13.0±1.0	14.0	25.119
5775	Ant1	12.75	13.0±1.0	14.0	25.119

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
28.184	3.23	0.012	1.0	PASS

Note: 1) Refer to report No. GTS202002000019F02 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (28.184 \cdot 2.1) / (4 \cdot 3.1416 \cdot 20^2) = 0.012$$