

## 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. with the text 'GLOBAL TESTING' and 'GTS' in the center. Overlaid on the logo is a handwritten signature in black ink that appears to read 'Robinson Lo'.

**Robinson Lo**  
**Laboratory Manager**

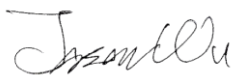
This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## 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**

## 2 Contents

|                                              | Page |
|----------------------------------------------|------|
| 1 VERSION .....                              | 2    |
| 2 CONTENTS .....                             | 3    |
| 3 GENERAL INFORMATION .....                  | 4    |
| 3.1 GENERAL DESCRIPTION OF EUT .....         | 4    |
| 3.2 GENERAL DESCRIPTION OF 2.4G WIFI .....   | 4    |
| 3.3 GENERAL DESCRIPTION OF 5G WIFI .....     | 4    |
| 4 RF EXPOSURE EVALUATION .....               | 6    |
| 4.1 RF EXPOSURE COMPLIANCE REQUIREMENT ..... | 6    |
| 4.1.1 Limits .....                           | 6    |
| 4.1.2 Test Procedure .....                   | 6    |
| 4.2 1.1.3 EUT RF EXPOSURE EVALUATION .....   | 7    |

## 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:      | <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location                                                   |
| Power Supply:     | INPUT: 100-240V~50/60Hz 1.0A Max<br>OUTPUT: 12V---2.0A                                                                                                               |

### 3.2 General Description of 2.4G WIFI

|                       |                                                                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Frequency:  | IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz<br>IEEE 802.11n(HT40): 2422MHz to 2452MHz                                                                     |
| Channel Numbers:      | IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels<br>IEEE 802.11n HT40: 7 Channels                                                                          |
| Channel Separation:   | 5MHz                                                                                                                                                     |
| Type of Modulation:   | IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE for 802.11g : OFDM(64QAM, 16QAM, QPSK, BPSK)<br>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<br>IEEE802.11n/ac(40M): 5150MHz ~5250 MHz<br>IEEE802.11ac(80M): 5150MHz ~5250 MHz<br>IEEE 802.11a/n/ac(20M): 5725MHz ~5850 MHz<br>IEEE802.11n/ac(40M): 5725MHz ~5850 MHz<br>IEEE802.11ac(80M): 5725MHz ~5850 MHz                                                                 |
| Channel Numbers:     | IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel<br>IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel<br>IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel<br>IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel<br>IEEE 802.11n/ac(40M): 5725MHz ~5850MHz/ 2 channel<br>IEEE 802.11ac(80M): 5725MHz ~5850MHz/ 1 channel |
| Channel Separation:  | IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz<br>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)<br>IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>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<br>(MHz)                                       | Electric field<br>strength<br>(V/m) | Magnetic field<br>strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|----------------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|-----------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                                     |                                     |                                        |                             |
| 0.3–3.0 .....                                                  | 614                                 | 1.63                                | *(100)                                 | 6                           |
| 3.0–30 .....                                                   | 1842/f                              | 4.89/f                              | *(900/f <sup>2</sup> )                 | 6                           |
| 30–300 .....                                                   | 61.4                                | 0.163                               | 1.0                                    | 6                           |
| 300–1500 .....                                                 | .....                               | .....                               | f/300                                  | 6                           |
| 1500–100,000 .....                                             | .....                               | .....                               | 5                                      | 6                           |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                                     |                                     |                                        |                             |
| 0.3–1.34 .....                                                 | 614                                 | 1.63                                | *(100)                                 | 30                          |
| 1.34–30 .....                                                  | 824/f                               | 2.19/f                              | *(180/f <sup>2</sup> )                 | 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/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi$  = 3.1416

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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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.

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

## 2) For 5G WIFI

### Measurement Data

| 802.11a mode       |         |                               |                            |                       |        |
|--------------------|---------|-------------------------------|----------------------------|-----------------------|--------|
| Test channel       | Antenna | Average Output Power<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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.

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