



RADIO EXPOSURE TEST REPORT

FCC ID : O6ZHS17R2
Equipment : Digital Satellite Receiver(Headless DVR Server)
Brand Name : DIRECTV
Model Name : HS17-500
Applicant : HUMAX Co., Ltd.
HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu ,
Yongin-si, Gyeonggi-do, South Korea 17040
Manufacturer : HUMAX Co., Ltd.
HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu ,
Yongin-si, Gyeonggi-do, South Korea 17040
Standard : 47 CFR Part 2.1091

The product was received on Oct. 28, 2016, and testing was started from Oct. 28, 2016 and completed on Mar. 06, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

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Photographs of EUT v01



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Note: Reference to Sporton Project No.: 6O2615

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Cathy Chiu



1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5250 5250-5320 5500-5720 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)



1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	Airgain	N24X2H2YN-W98U	PIFA	U.FL	Note1
2	2	Airgain	N24X2H2YW-B95U	PIFA	U.FL	
3	2	Airgain	N5X35B2YN-E57U	PIFA	U.FL	
4	1	Airgain	N5X35B2YN-R137U	PIFA	U.FL	
5	3	Airgain	N5X35B2YW-G80U	PIFA	U.FL	
6	4	Airgain	N5X35BYN-A100U	PIFA	U.FL	

Note1:

Ant.	Port	Antenna Gain (dBi)				
		WLAN 2.4GHz	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3
1	1	1.15	-	-	-	-
2	2	1.15	-	-	-	-
3	2	-	2.46	2.59	3.58	3.38
4	1	-	2.93	3.23	4.55	3.68
5	3	-	3.5	3.28	4.42	4.59
6	4	-	4.57	4.23	5.18	5.06

Ant.	Port	Directional Gain (dBi)											
		WLAN 5GHz UNII 1			WLAN 5GHz UNII 2A			WLAN 5GHz UNII 2C			WLAN 5GHz UNII 3		
		4T1S	4T2S	4T4S	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S
3	2	5.29	4.57	4.57	4.86	4.23	4.23	6.08	5.18	5.18	5.9	5.06	5.06
4	1												
5	3												
6	4												

Note2: The above information (excepting antenna gain of 5GHz UNII 1~UNII 3) was declared by manufacturer.

Note3: 5GHz UNII 1~UNII 3: Maximum Directional Gain following KDB662911 D03.

Note4: The above information was declared by manufacturer.



Note5: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

$$N_{SS1}(g1,1) = 10^{G1/20} ; N_{SS1}(g1,2) = 10^{G2/20} ; N_{SS1}(g1,3) = 10^{G3/20} ; N_{SS1}(g1,4) = 10^{G4/20}$$

$$g_{j,k} = (N_{SS1}(g1,1) + N_{SS1}(g1,2) + N_{SS1}(g1,3) + N_{SS1}(g1,4))^2$$

$$DG = 10 \log[(N_{SS1}(g1,1) + N_{SS1}(g1,2) + N_{SS1}(g1,3) + N_{SS1}(g1,4))^2 / N_{ANT}] => 10$$

$$\log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{ANT}]$$

Where ;

$$2.4G G1 = 1.15 \text{ dBi} ; G2 = 1.15 \text{ dBi} ;$$

$$2.4G DG = 4.16 \text{ dBi}$$

For 2.4GHz function:

For IEEE 802.11b/g (1TX/1RX)

The EUT supports the antenna with TX and RX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

For IEEE 802.11n (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac/ax (4TX/4RX):

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.



1.3 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter	DIRECTV	EPS17R0-15	INPUT: 120 V ~ 1.8 A, 60Hz OUTPUT: 25.2 V, 2.86 A, 72W

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2.1091
 - ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01
- The following reference test guidance is not within the scope of accreditation of TAF.
- ♦ 47 CFR Part 1.1307
 - ♦ 47 CFR Part 1.1310

1.5 Testing Location

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.



2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
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

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
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

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$



2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

R between the person and the antenna / radiating structure, where $R > \lambda / 2 \pi$.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ² .
1.34-30	3,450 R ² /f ² .
30-300	3.83 R ² .
300-1,500	0.0128 R ² f.
1,500-100,000	19.2R ² .

Note: R is in meters, f is in MHz.



2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	1.15	25.55	24.55	0.50	319.890	20	B	3060.0	0.1046
5.2G;D1D	5.29	29.97	33.11	0.50	2296.149	20	B	3060.0	0.7506
5.3G;D1D	4.86	23.95	26.66	0.50	519.996	20	B	3060.0	0.1700
5.6G;D1D	6.08	23.87	27.80	0.04	608.135	20	B	3060.0	0.1988
5.8G;D1D	5.90	29.88	33.63	0.21	2421.029	20	B	3060.0	0.7915

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz+WLAN 5GHz+Bluetooth

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	1.15	25.55	24.55	0.50	319.890	20	B	3060.0	0.1046
5.8G;D1D	5.90	29.88	33.63	0.21	2421.029	20	B	3060.0	0.7915
Sum TL Ratio_B	0.8961								
Ratio Limit	1								

Note: The above antenna gain of 2.4GHz was declared by manufacturer.

————THE END————